Charles University

Faculty of Social Sciences
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MASTER'S THESIS

An investigation of Foreign Currency loans exposure contribution to the soundness of the Financial System

(Case of Balkans and CEE Countries)

Author: **Bc. Eda Özalan**

Supervisor: **Doc. Ing. Zdeněk Tůma CSc.**

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Declaration of Authorship

The author hereby declares that he compiled this thesis independently; using only the listed resources and literature, and the thesis has not been used to obtain a different or the same degree.

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Prague, May 11, 2018

Signature

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Abstract

This thesis investigates the impact of foreign currency lending on financial stability for the case of Balkans, CEE and Balkans and CEE together. Such investigation has been carried out by identifying the impact of foreign currency lending across 3 main channels, which are: 1) households, 2) non-financial corporations, and 3) central government. This thesis was able to prove the foreign currency lending relevance, significance, main impact, and remarkable heterogeneity characterizing the Balkans and CEE samples. With respect to each of the subsamples and the full sample, the results can be summarized in 3 main points. For the case of Balkans, the financial instability has been identified to be transmitted through the household and government channels. Regarding the CEE, the dynamics are completely different as household channel provides mixed evidence, while the non-financial corporation one serves as the main transmission channel. When investigating the full sample, it has been pointed out that the prevailing dynamics reveal the non-financial corporation and government channels as the ones with the largest contribution to financial instability.

JEL Classification	C33, C36, F34, G20, G21, G32,
Keywords	Financial stability, foreign currency lending, household, non-financial corporation, central government

Author's e-mail	edaozalan@hotmail.com
Supervisor's e-mail	zdenek60tuma@gmail.com

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Acronyms

CEE	Central and Eastern European
FIH	Financial Instability Hypothesis
NPL	Non-Performing Loans
ROA	Return on Assets
ROE	Return on Equity
FX	Foreign Currency
RWA	Risk-Weighted Assets
ADF	Augmented Dickey-Fuller
PP	Pearson
GMM	General Method of Moments
2SLS	2 Stage Least Squares
OLS	Ordinary Least Square
FE	Fixed Effects
IV	Instrumental Variables

Master's Thesis Proposal

Author:	Bc. Eda Özalan
Supervisor:	Doc. Ing. Zdeněk Tůma, CSc.
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Proposed Topic:

An investigation of FX loans exposure contribution to the soundness of the Financial System

Motivation:

Foreign currency loans exposure has withdrawn a great attention in the recent years since they comprise a significant part of the banking sector portfolio and they are among the most important determinants of systemic risk in banks, as investigated by Yeşin (2013). It is proven in many studies that an increase in foreign currency loans exposure could lead to potential negative effects in the financial sector, for example like in the case of Hungary or Romania, Buszko & Krupa (2015). In times where financial system's soundness and resilience are key objectives of every country, it is judged that a research on this topic would be beneficial.

This study aims to identify the portion of foreign currency loans in a group of countries, which are driven by households and corporates demand. In addition, it is important to determine the factors influencing the two former categories in contributing to the exposure. Brown, Ongena & Yeşin (2009), provided a detailed investigation on firms demand for foreign currency loans by determining several characteristics and grouping firms into several categories. Even though they provide good information behind the reasons pushing firms toward FX loans, they do not provide specific information on the firm's contribution to this exposure. In addition, Patnaik, Shah & Singh (2016) studied the FX borrowings of Indian firms by taking into account only the policy implications. Moreover, Brown & De Haas (2010) studied FX lending in emerging Europe, aiming to identify the relevance of macroeconomic factors and banks ownerships in impacting the FX lending level. Furthermore, Brzoza-Brzezina, Chmielewski & Niedźwiedzińska (2010), studied the role of central banks in substituting the domestic currency loans with FX loans for the case of CEE countries. Their results confirmed the relevance of monetary policy as an important determinant of the potential substitution, leading to the conclusion that central banks do have a significant role in shaping the demand for FX loans. For the households level it was not possible to provide essential information due to the lack of literature considering this factor. Since the role of individuals in FX loans exposure is not yet considered by the literature, and because of the suspicion that it might be factor of a significant relevance I propose to carry this research and investigate the truth on the claims.

Lastly, the study also has the intention to assess the contribution of these drivers into the stability and soundness to the respective countries financial systems in the sample.

Hypotheses:

1. Hypothesis #1: Foreign currency loans are a significant factor to be considered, when assessing the resilience of the financial system.
2. Hypothesis #2: Households demand for foreign currency loans is the main driver behind the significant increase in the exposure
3. Hypothesis #3: Countries with a higher level of foreign currency loans experience a higher level of systemic risk and their financial system is more fragile.

Methodology:

In order to test the hypothesis and provide a good assessment on the topic two methodologies will be employed. The first assessment would be by using as an indicator of financial stability the z-score for each of the countries, and later on apply it on a regression analyses. For the second assessment of stability, NPL ratio will be used, as it is considered to be a good indicator. Other variables serving as explanatory will be the households and non-financial institutions loans in foreign currency. Aiming to reveal the differences among countries and to see their extent of contribution to the financial system's stability, Fixed and Random effects and GMM methodologies will be employed.

Expected Contribution:

This study is expected to contribute to the literature by further determine the contribution of an increase in foreign currency loans exposure to the financial system of a country. Based on countries specific characteristics it aims to identify the drivers by revealing the differences among them, hoping that this identification could help policymakers in shaping the demand for foreign currency loans. Moreover, since the financial soundness and stability are key goals of every country and since there is a gap in the literature regarding this potential indicator, it is proposed to carry the research.

Outline:

The study is expected to be built in six chapters, starting with an introduction of the main topic, statement of the core research questions, revealing the main developments on the subject and stating the expectations and the organization of the study. The second chapter will be dedicated to the existing literature, followed by a third chapter on data and methodology, which focuses on revealing the variables and the methodology to be employed. The coming chapter aims to provide a qualitative assessment of the countries in the sample, in order to offer an alternative view of the situation by performing a detailed analysis and also visualize the situation among different countries in the sample. It aims to identify the differences and the severity of foreign currency lending among countries with different exposures. Next chapter will be dedicated to the empirical findings where the methodology explained in chapter three will be applied. Lastly the study will be closed with a conclusion, which will summarize the analysis, the results and will provide the final answers to the research questions.

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Author **Supervisor**

1 Introduction

Financial stability represents one of the main concerns of policymakers as its preservation is vital for economic growth and development. Simply by recalling the past 15 years episodes of the financial crisis, it is more than evident that such events have remarkable power upon abruption of the entire financial and economic aspects of a country. While considering the most recent financial crisis, which concretely are the global financial crises and the sovereign debts crisis, a few stylized facts with respect to financial instability can be drawn. Firstly, the financial instability of any kind, origin, and magnitude should be treated with seriousness and in a timely manner. Secondly, financial markets and their developments are largely interrelated or interconnected with global developments due to the high degree of globalization. As such, potential instability factors should be studied and investigated not only on the country level but at the regional level as well.

Foreign currency lending has been identified and acknowledged as one of the main drivers of financial instability in the studies of Brown, Ongena & Yesin (2011), Brown & de Haas (2010) and Yesin (2013). Nowadays the foreign currency loans comprise a significant part of the banking sector portfolio and they are among the most important determinants of systemic risk in the banking sector. Such phenomenon has been largely identified in the Central and Eastern European region and the existing literature is largely focused on this sample. Meanwhile, the former studies have only considered certain aspects of foreign currency lending, such as specific channels, macroeconomic factors behind such phenomenon and the role of monetary authorities in shaping the demand for these kinds of loans.

However, there are significant gaps in the literature regarding the relevance of foreign currency lending through household and government channel as generally the main focus has been centered on non-financial corporation channel. This means that all 3 channels have not been assessed together under one specific model, but rather separately. In addition, the literature is largely constrained in studying the central European sample in general and has not considered other regions in Europe where this phenomenon is largely pronounced as well.

This thesis aims to verify the relevance of foreign currency lending in explaining financial instability by taking into consideration its dynamics across three main channels. More concretely, it takes into consideration foreign currency lending to households, non-financial corporations, and central government institutions. In

addition, this thesis consideration is a sample composed of Balkans and CEE (Central and Eastern European) countries, which will be investigated separately and together as well. While carrying the investigation in a similar way, it will be possible to reveal region differences and characteristics. Such findings would further contribute to the literature by providing additional evidence on region-specific developments due to the presence of such phenomenon. Moreover, another part of the study will be focused on investigating the regions under a single sample, thus identifying the prevailing dynamics and identifying the dominant effects.

Furthermore, this investigation will be carried by making use of several econometric models. More specifically, the analyses will be conducted under the pooled OLS, fixed effects, instrumental variables and general method of moment models. The considerable number of methods to be used is fueled by the motivation of achieving significant, consistent and robust results. Supporting the former argument on results robustness, this thesis employees two indicators of financial instability, which are z-score and non-performing loans ratio. The variable of z-score for the banking sector is substantially considered by literature and finds support on the studies by Uhde & Heimeshoff (2009), Pradhan (2014) and more recently by Xiping, Tripe & Malone (2017). Regarding the motivation behind non-performing loans ratio, it can be argued with the ease of calculation, implementation, and comprehension provided by this variable. It will mainly serve for robustness check and argumentation support against existing criticism on the z-score measure.

The contribution of this thesis to the current literature is threefold. Firstly, through this study is being provided an extension of the literature to the recent years. Secondly, the studied sample has not been exploited before in terms of variables, the range of methodologies and comparative analysis. Thirdly, the investigation of all three foreign currency lending channels together has not been assessed before, as the current literature either focuses on the foreign currency loans in total, on household, or on non-financial corporation channels. Investigation across each of the formerly mentioned channels contributes by identifying the prevailing dynamics and the characteristics of each sample.

However, this thesis faces several limitations reflected mainly on the creation of the dataset and methodological requirements satisfaction. Related to the dataset, it is important to highlight that the data availability is very constrained, thus forcing us to exclude from the analyses countries with lack of data. In addition, the methodological constraints materialize when studying the sample of CEE, which suffers from the non-stationarity remedy. Such issue leads to spurious regressions and unreliable results, thus forcing us to correct it by making use of first differencing.

Unfortunately, this solution abrades the heterogeneity in the data, thus removing the main thing that we try to investigate. In presence of such issue, the literature suggests usage of the general method of moments and this method has been applied. Unfortunately, more robust results could be obtained by making use of vector autoregressive model and causality analyses for panel data, but such solution is beyond the scope of this thesis.

Lastly, the remaining part of the thesis is structured as follows. The second chapter will be dedicated to the existing literature, followed by the third chapter on dataset discussion. In addition, the fourth chapter will be focused on methodology, which will explain the variables and the empirical models to be employed. The fifth chapter will be dedicated to the empirical findings where the methodology explained in chapter four will be applied to each of the regional and overall samples. Finally, the study will be closed with a conclusion, which will summarize the analysis, the results and will provide the final answers to the research questions. Further parts of the thesis will provide the bibliography and the list of appendices where will be summarized the main theory behind tests and statistics used and the output of empirical estimation not displayed in the chapter.

2 Literature review

2.1 Financial Stability

Every country's public policy for more than last 15 years has been focused on achieving financial soundness and stability, by making this the main goal. As making such a strong statement for the main goal of the public policy generates many questions, it would be relevant firstly to start providing answers to the question "why?".

Early, Crockett (1997) was among the firsts to acknowledge the becoming of financial stability as the main goal of public policy. His analyses were simple and were generally based on revealing the main causes why this issue apart from being a matter of supervisory authorities had consequently shifted to public policymakers as well. The economic developments during that period were found to be the main reason for making financial stability the main goal. As the financial transactions volume grew, the complexity of financial instruments increased and the costs associated with crises was enormous, financial stability was seen as the only way of minimizing the risks and the costs.

Unlike the former author who acknowledged the financial stability goal to public policies as well, Mishkin (1997) goes one step back in providing evidence for policymakers on how responding to financial instability is simply related to price stability. In the study, the author continuously assesses the importance of price stability and considers the achievement of such goal equal to financial stability achievement. By providing the example of countries with past history of high inflation and low credibility of the banking sector, which lead to shorter duration of bank contracts and to the pursuance of an expansionary policy for the respective cases, the importance of low and stable inflation is highlighted.

Right after acknowledging the price stability goal as an analogy of financial stability, Bernanke and Mishkin (1997) studied the relevance of this framework for policymakers. The inflation targeting policy, pursued as a stabilizing policy as well, was implemented in many countries and its impact on monetary policy was mainly recognized in increased coherence, transparency and discipline. In addition, the study showed an improvement of financial stability in countries pursuing such policy. Supporting the stabilizing effects of low inflation, Hayo (1998) admits that there is evidence supporting the claim that there exists a stability culture in low inflation

countries. Moreover, Mishkin (2000) in his study finds supporting pieces of evidence that even though the price stability may not work the same for every country its overall impact on financial stability is positive. But as Borio & White (2004) concluded on their study, inflation targeting works well but is not the solution to all of our problems as some of them cannot yet be reached, at least through this policy only.

As the monetary policy seems to have a significant impact in achieving financial stability, it is worth pointing out that sometimes the impact may not be direct and not always at the same level of efficiency or efficacy. Early, Minsky (1992) in his famous paper named "The Financial Instability Hypothesis" (FIH) indicates that a long period of prosperity, low inflation, and financial stability has a high probability of being followed by a period of financial stress. The hypothesis is built in response to internally generated shocks and explains the financial distress based on the dynamics of the economy and the interventions or regulations that are expected to keep the economic development stable.

Considering that the prediction of financial distress episode is very difficult to be conducted, Borio & Lowe (2002) proved that it is not impossible, even though it may be struggling. In their study they argue that the financial imbalances can become present even in a low inflation environment, suggesting that the identification of these imbalances before-hand is a difficult task for not saying impossible. The empirical observation provides good incentives for predicting such episode simply by focusing on fast credit growth and abnormal increases in asset prices. According to such observations, it is judged that a policy response to changes in asset prices and credit growth could accommodate the economy from an unexpected financial distress episode. Even though it may accommodate the financial situation temporarily, according to Assenmacher & Gerlach (2008) the effects of such intervention may be reflected elsewhere. More concretely, the intervention to offset the increase in credit level and asset prices would impact the economic activity as a consequence of financial frictions generated by the policy.

The impact of financial frictions in decreasing the economic activity has been assessed in several cases where we can bring the case of Korea by Gertler, Gilchrist, & Natalucci (2007). This study is a pure example of financial frictions impact on being responsible for almost half of the decline in economic activity. After quantifying these impacts the domino effect still continues as according to Bernanke, Gertler, & Gilchrist (1999), financial frictions and the decrease in economic activity may generate conditions for the creation of macroeconomic shocks or may give birth

to the process known as the financial accelerator. All this chain of consecutive effects provokes an increase in the financial instability.

Among others when studying the financial stability an investigation on the internal structure is of key importance as it reveals characteristics and developments able to explain the dynamics. Nier, Yang, Yorulmazer, & Alentorn (2007), investigated the impact of financial system structure on systemic risk. The authors find supportive pieces of evidence for the positive impact of capitalization in financial stability as better capitalized banks are able to survive from financial distress episodes. On the other hand, the interconnectedness provides mixed evidence as initially contributes to contagion effect and after a point is able to reduce it. In addition, the increase of interbank liabilities and a high level of concentration are found to exert positive contribution in increasing systemic risk. When considering the dynamics based on the internal characteristics of the country in terms of being a bank based or market-based financial system, it is relevant to understand the banking and capital market developments.

2.2 Role of Banks & Capital Requirements

In the bank-based system, banks are the key player in organizing the financial sector and need no significant collaboration with capital markets, while in the market-based system banking and capital market developments walk side by side as pointed out by Adrian & Shin (2008). In a sense, the identification of such relation tends to support the view that monetary policy and financial stability are linked. With the intention of improving the latter one, innovations like credit securitization were allowed. Apparently, as Shin (2009) found in his study, the securitization did not achieve its goal. Aiming to decrease credit risk, this strategy enhanced credit expansion due to the belief that no money could be lost as the securities were backed up by high-quality assets. Even though in principle it was assumed to be like that, in reality, it completely failed due to decreased lending standards as it was witnessed during the global financial crises. Yet the crisis witnessed once again that central banks are the one cleaning the mess after every episode of financial distress. As Stein (2012) points out, the importance of monetary policy is unquestionable and its direct impact and influence on the financial system are beneficial to the soundness of the system.

When speaking of financial stability everyone refers to the banking sector and among the bank characteristics, capital is of a great importance. Among the firsts to investigate the role of capital, Berger, Herring, & Szegö (1995) try to understand the importance of capital burdens and explain the requirements as well. They were able to reveal the composition of capital by supporting their reasoning on the regulatory

capital requirements and on the market-generated requirements. Capital is partly perceived as a requirement from the regulator and partly determined internally in accordance with banks' internal risk assessment. Generally, the regulatory capital requirements are set up by the supervisory authorities of each country, thus providing an additional tool to preserve the financial system soundness and stability. It is a well-known fact from the financial theory that capital is a good burden against financial distress and as having such characteristic everyone should expect it at high levels, but that is not necessarily the case. Holding capital in excess would be very costly to a financial institution as money would be sitting there and the interest income on it would be irrelevant compared to the opportunity cost of lending. As a result financial institutions try to find the optimal level of capital by making a trade-off between profit and financial stability in a sense.

When studying the impact of monetary policy on financial stability, De Graeve, Kick, & Koetter (2008) found among others that distress is larger in those banks whose capitalization is low and as a result, in times of financial instability they would likely fail. An important implication from the paper is that the collaboration between supervisors and policymakers is crucial and can help in better controlling the financial distress. As till now capital requirements, burdens, and well capitalization topics are introduced, it is important to shift to the determinants of the capital structure. In spirit of the capital structure determinants, Gropp & Heider (2010) carried out an investigation on the main capital determinants till the year 2004, and in their findings, they classify the influencing factors in two classes according to the importance. The most significant determinant was found to be time-invariant bank fixed effects model, while factors like mispriced deposit insurance or regulation could be classified in the second class.

Aside from the influencing factors, Borio & Zhu (2012) explain the link between capital regulation, risk taking, and monetary policy. Their findings suggest that the update of financial regulation together with changes in the financial system has created the need to create a risk-taking channel as the perception and pricing of risk link with monetary policy has to be taken into account. In addition, they also imply the non-relevance of current models in providing good implications to policymakers, thus misguiding their actions. Moreover, Borio (2014) evaluates the role of monetary policy in preventing and recovering from financial distress. His study reveals that the financial stability issue goes beyond the monetary policy itself, but the role of the latter one is so important that it cannot escape its responsibility. Also, it is pointed out the difficulty of maintaining both monetary and financial stability at the same time since many studies have shown that one is maintained at the expense of the other. More importantly, the ability of the central bank to attain its

credibility and trust is crucial to the success of its policies is heavily depended on that.

During the history, many developments and innovations have had important quantifiable effects on financial markets and as a result of financial stability. Through years the process of globalization has been observed everywhere and of course, the banking sector does not make an exclusion. With the increased level of capital mobility and world's financial interconnection, many foreign banks opened their subsidiaries in many countries. Early, Demirguc-Kunt, Levine, & Min (1998) investigate the impacts of foreign banks on domestic financial stability, efficiency and economic growth. Their results provided positive evidence suggesting that the entrance of foreign banks increases financial stability by lowering the possibility of experiencing a banking crisis, increases efficacy but in the same time lowers the profits of domestic banks and also positively impact economic growth.

Even though the general contribution is positive, the needs of a country for having a large number of banks according to Ongena & Smith (2000) are closely related to the efficiency of the internal judicial system and enforcement of creditor rights. In addition, the number of banks is expected to be higher in un-concentrated and stable markets. The authors were able to conclude such results based on firms relationships to numerous banks. Moreover, Hull (2002) considers the characteristics of a country like New Zealand which is almost totally dominated by foreign banks. Even though the diversification is low the majority of the market share is controlled by five foreign banks. The results indicate various problems coming as a result of foreign ownership of banks. More concretely the problems can be found in the inability of domestic banks to respond to a crisis in case foreign banks pursue a different strategy, exposure to external shocks due to increased leverage, foreign exchange risks, and spillover effects. The negative impact due to the formerly mentioned factors is also contaminated by the low level of ownership diversification, which as a result creates high dependencies between New Zealand in this case and the home countries of the foreign banks.

Another study by De Haas & Van Lelyveld (2006) investigated the behavior of foreign banks during crises and their financial health issues. The findings suggest that they respond differently to financial instability, as contrary to the domestic banks which lower the credit growth, the foreign banks continue at the same rhythm. In addition, they are significantly impacted by the conditions in their home countries and by the financial health of their parent banks as well. These findings lead us to confirm the former study's results, which expected to encounter such problems in case of financial instability.

When shifting to the case of developing countries Yeyati & Micco (2007) considered the impact of foreign banks penetration in a group of developing countries. The estimated results suggest a positive impact of foreign banks in financial stability, even though the concentration in the market has increased and the competition is reduced. Apparently, the stability generated at the expense of lower competition can be explained by low credibility and low capitalization of domestic banks. The argument that lower level of competition positively contributes stability has been earlier assessed by Allen & Gale (2004), which found supportive evidence concluding the positive relation towards efficacy and negative relation towards stability. Following the case of emerging economies, Vogel & Winkler (2010) studied the contribution of foreign banks in stabilizing the financial environment during the global financial crisis. The estimated results indicated an inability of foreign banks to extensively contribute to the stabilization as they are strongly influenced by the developments in their home countries, thus confirming the previous findings. Financial integration as a result of globalization is an important factor determining the influence of external shocks to the domestic credit.

In a more recent study, Claessens & Van Horen (2014) evaluate the impact of foreign banks by accounting for countries heterogeneity. Without giving a precise implication the authors conclude that the only countries where the impact on credit would be negative are the low-income countries. In addition, countries were the foreign banks would have a low market share and where information asymmetries are present, represent larger instability.

2.3 Foreign Currency Lending

After elaborating the concept of financial stability, its influence, main factors, and components, it is relevant to shift to the foreign currency loans, which is the main point that this study aims to discuss. Being a new concept in the range of factors impacting stability, Brzoza-Brzezina, Chmielewski, & Niedźwiedzińska (2010) were among the firsts to account for the increase in foreign currency loans and the substitution of domestic currency loans with the former one. In addition, the study aimed to address the role of central banks while observing the phenomena. The estimated results provide strong evidence regarding the substitution effect and support the view that central banks actions have an important role in it. More concretely, as central bankers pursue a restrictive policy the level of domestic currency loans exhibits decreasing trend, while the foreign currency loans on the other hand experience a significant increase.

Literature provides certain implications regarding the potential effects of foreign currency loans in increasing financial instability. Based on such implications Bordo, Meissner, & Stuckler (2010) assesses the impact of foreign currency debt on output for the case of eastern Europe. The results confirm the suspicion on the negative impact as the output losses materialized due to its influence, making the system more prone to crises. As the foreign currency loans are accepted as a phenomenon exerting a negative impact on stability, Brown, Kirschenmann, & Ongena (2010) try to identify if it comes as a result of demand or supply. According to the results, the authors concluded that banks themselves play a significant role by supplying loans in foreign currency. Banks are more likely to adopt this strategy when they have abundance in foreign currency or in cases when they need to match the structure of their assets to the structure of their liabilities. In addition, the borrowers start demanding loans in foreign currency as in former situations the interest rates are lower. So it is implied that it is both supply and demand driven phenomena.

As the foreign currency lending generally is a characteristic that can be observed in developing countries, Brown & De Haas (2010) investigated the factors behind such developments in the emerging economies. The observations revealed that the ownership structure was a second level influence in giving rise to foreign currency lending as the main cause behind it is found to be the macroeconomic environment. Since not enough evidence could be found to support the view that foreign banks push customers toward these types of loans due to easier access to funding in foreign currency, we come at a contradiction with the previous study which assumes the inverse. In addition, the results suggest that foreign currency loans are generally channeled towards retail customers rather than towards corporate customers as the former one represents a larger portion of the loan portfolio.

Moreover, another finding supporting the former claim on pointing macroeconomic environment as the main factor to cause such situation is the fact that domestic banks have higher rates of lending in foreign currencies. After studying and recognizing the effects on stability, the forces driving the demand and supply and the main influencing factors behind it, Ostry, Ghosh, Chamon, & Qureshi (2012) go one step further in searching ways of reducing and controlling the impact of foreign currency lending. Based on the indices from former papers the starting point for searching on such issues definitively would be the macro-prudential policies and capital mobility control. The estimated results from the study indicate that the relevance of exerting control on capital mobility and prudential policies is positively associated with a decrease in foreign currency lending. In addition, it is claimed that keeping these type of loan under control during booms could improve the resilience

of the system under bust. Unfortunately, there are countries which cannot exhibit this kind of policies as they are committed to other regulations. A pure example would be considered the case of European Union members, where capital mobility is one of the main foundations behind the motivation for a united Europe.

Furthermore, one of the measures the former study suggests is exerting control on capital mobility, but such action could produce unknown consequences. Consideration of such issue by Rey (2015) provided the literature with a so-called dilemma of independent monetary policy if and only if capital account is managed. Evaluating the costs of such intervention as massive, the author comes at certain policy implications to be pursued in order to manage the capital mobility and maintain the independence of monetary policy as well. Mainly all the implications of this study focus on targeting policies, restrictions on leverage, the imposition of control in the transmission channel and making use of macroeconomic policies as well.

It is important that apart from considering the phenomena, in general, to pay attention to its division into wholesale and retail foreign currency loans. The study of Brown, Ongena, & Yesin (2011) provides among others an analysis of why small firms in transition economies prefer foreign currency loans instead of domestic currency ones. Taking into consideration the type of currency in which income streams and assets are denominated the results suggest a tendency of firms whose assets and income are not denominated in the domestic currency to borrow in foreign currency. In addition, other factors playing an important role in supporting the increase of lending in foreign currency are found to be the high presence of foreign banks, information asymmetry and lack of capital control. It is important that to point out that all these factors have been mentioned in the former studies as well, thus confirming once again their relevance.

Moreover, Ongena, Yesin, & Brown (2014) further assessed the impact of information asymmetry and confirm its impact in shifting customers towards foreign currency lending. According to the results, the presence of this factor impacts not only the firms whose assets and income streams are denominated in foreign currencies but also those firms whose assets and income are denominated in domestic currency.

Unlike the former authors' outcome on information asymmetry influence, Mora, Neaime, & Aintablian (2012) which focused only on dollar-denominated debts conclude that the presence of asymmetries reduces the level of lending in this currency. As there is a difference among studies in terms of generalizing foreign currency loans and specifying in a single currency the dynamics may be different. In

support of this argument, we can use the implications from the study of Yesin (2013), which evaluates the contribution of different currencies to systemic risk. The estimated results suggested variations among currencies and also defined some of them as non-contributing to the systemic risk at all. These findings lead us to believe in different variations among currencies when considered separately and agree on the conclusion that the aggregated effect is the one quantified in the above-mentioned studies.

Another important stream of foreign currency loans is channeled to the households and they are believed to be a significant factor accounting for the increase in this type of loan. Considered by Steiner (2012), the household loans comprise a significant part of banking portfolio and their denomination in foreign currency has become more and more attractive during years. The study's main finding in explaining the data pattern was based on the interest rates, which were found to be much lower in comparison to interest rates in domestic currency. This is relatively a significant factor, as even though considered in the former studies it was not found to be relevant to the extent of solely accounting for the increase in foreign currency lending. Anyway, the difference can be accounted on the study group of clients since the former papers have been focused on the matter in general or have only focused on firms based data.

Moreover, Fidrmuc, Hake, & Stix (2013) considered the foreign currency loans demand driven by households for the case of CEE countries. Apart from acknowledging the contribution of foreign currency loans in increasing systemic risk, the authors provide reasoning on potential demand drivers. Unlike the former study, this case presents additional factors which are the lack of trust in the stability of the domestic currency and lack of trust in the institutions. In addition, it provides pieces of evidence suggesting that factors like remittances and euro expectation adoption play a significant role in certain regions, thus claiming heterogeneity and the need to account for it when estimating the results.

All in all, the literature agrees on the main point of recognizing foreign currency lending as an important influence on financial instability increase. In addition, it is important to account for all channels supporting the growth of this type of credit as each of the channels provides useful information for policymakers. And lastly, such issue has to be considered by policymakers in order to impose control and restrictions as the situation may aggravate, especially during busts.

3 Data

This thesis brings a unique dataset, built to serve the purpose of investigating the relevance of foreign currency loans in explaining financial stability. The sample is composed of Balkan and CEE countries. Observations are arranged in yearly compounding and stand for the period from 2006 to 2015. Such sample choice is inspired from the former literature findings, suggesting the presence of foreign currency lending phenomena in a large scale in these countries. The data have been collected from multiple sources like Federal Reserve Bank of St. Louis, World Bank, The Global Economy and each of the samples' countries central banks.

In order to provide a better assessment of the phenomena this thesis investigates the foreign currency lending among three main channels, which are households, non-financial corporations, and government. Moreover, financial stability will be measured through the z-score variable and through non-performing loans ratio (NPL). Additional variables of interest are part of the dataset, so the omitted variable bias, endogeneity, and other model remedies will be limited.

Also, this part will serve to investigate graphically and through descriptive statistics the main characteristics of the sample. Moreover, several tests will be performed in order to ensure that the variables will be used properly and the model will not suffer from variable related remedies.

3.1 Dataset Discussion

This subsection will serve to provide main descriptive statistics for the main sample and subsamples as well. In addition, several graphical representations will be provided. It will be organized into two subsections related to the classification of variables as dependent and independent.

3.1.1 Dependent Variables

Based on the literature, common sense and economic theory, there have been selected two variables to measure the financial stability for this sample's countries. The first measure is the z-score, which indicates the likelihood of bankruptcy for the banking sector. Such measure is built based on core financial ratios, like return on assets (ROA), equity to assets and the former one's volatility. The second measure chosen for this study is the non-performing loans ratio, which indicates the extent of loans

out of the total portfolio, which are having significant issues, thus making their collection doubtful.

Z-Score

This variable is calculated as follows,

$$\mathrm{z-score} = \frac{\mathrm{ROA} + \left(\frac{\mathrm{equity}}{\mathrm{assets}}\right)}{\sigma \mathrm{ROA}},$$

where ROA stands for the return on assets, while the report between equity and assets indicate the banking system's capitalization. Such measure is commonly used in literature like for example in the case of Europe by Uhde & Heimeshoff (2009), in the case of India by Pradhan (2014) or more recently for the case of New Zealand by Xiping, Tripe & Malone (2017). Even though in the formerly mentioned studies such measure is found useful, there are also drawbacks related to its calculation as pointed out by Lapteacru (2016).

Banking z-score for the case of Balkans is averaged on 7.33 and is associated with a median of 5.88. Such measures indicate a financially stable financial environment. In addition, the maximum value observed in this sub-sample is found to be 15.64 and it is related to the country of Albania. This finding is surprising as the Balkans subsample includes among others, countries which are perceived as more secured in terms of financial stability. In addition, it is worth stating that such value is almost consistent for the entire sample period when speaking of Albania. Moreover, it is relevant to emphasize that the impact of the global financial crisis was minimal in this country. On the other hand, we have the lower extreme of 0.02 as determined by the minimum value. Such value is associated with the country of Greece and unlike the former case, it does not come as a surprise for the fact that Greece has been in a very severe financial situation during the last 10 years. This value is observed during the so-called sovereign debt crisis, which impacted many European countries, but especially Greece which was suffering the most. The fact that the sample period includes both the global financial crisis and the sovereign debt crisis has caused a significant increase in the value of standard deviation, which is found to be 3.51.

A similar situation is observed also in the second subsample of CEE countries. The z-score, in this case, is averaged on 6.17, with a median of 5.4, which compared to the former sub-sample are slightly lower. The maximum value as well as slightly lower amounted at 14.2 and associated with the country of Slovak Republic. It is relevant to highlight that similar to the former case of Albania, the Slovak Republic has been able to maintain an increasing trend of its banking sector z-score,

thus demonstrating the resilience of its financial system according to this measure. The minimum value of -0.34 on the other hand, represents a very concerning situation, which exceeds the disturbing value of Greece as well. This value is associated with the country of Slovenia during the period of the sovereign debt crisis. Luckily such low score has been immediately improved in the following year and has been maintained stable till by the end of the sample period. Other problematic countries in this sub-sample can be considered Estonia, Latvia, and Lithuania for some specific years since recently they have been able to overcome such issues. Regarding the volatility of this measure, the conclusion would be similar like in the previous case as the developments seem to be quite similar.

Furthermore, when grouped altogether mean was found to be 6.17 and the medians' value is 5.655. Also, the value of standard deviation remains high and this for the fact that the range of values is higher than in the two former sub-samples.

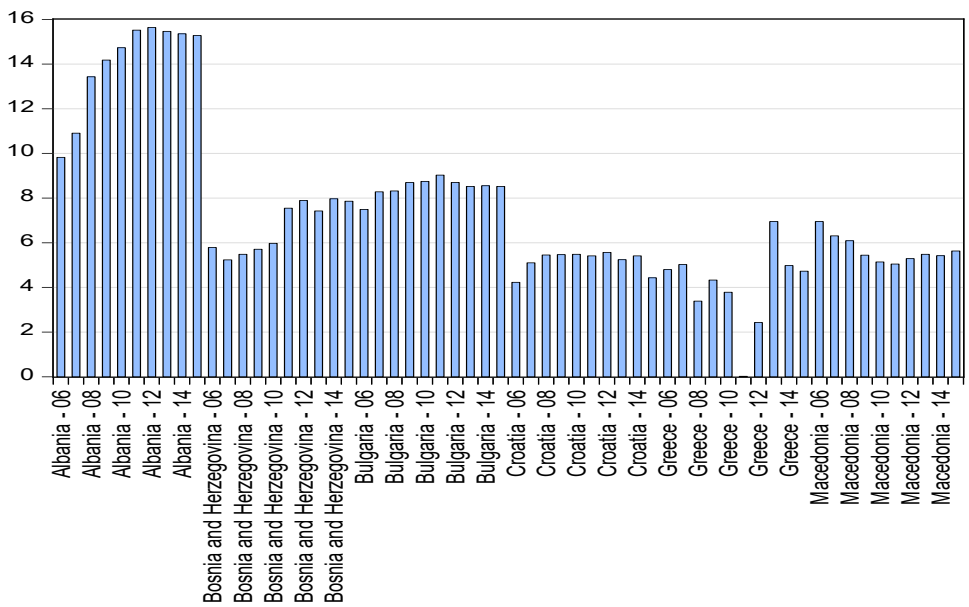
The summary of descriptive statistics can be found in table 3.1. In addition, the plot of z-score for the two subsamples can be found in figures 4.1 and 4.2.

Table 3.1: Banking System Z-Score Descriptive Statistics

Sample	Mean	Median	Max.	Min.	S. Deviation
Balkans	7.351333	5.88	15.64	0.02	3.531823
CEE	6.1745	5.405	14.2	-0.34	3.049911
Balkans & CEE	6.678857	5.655	15.64	-0.34	3.843561

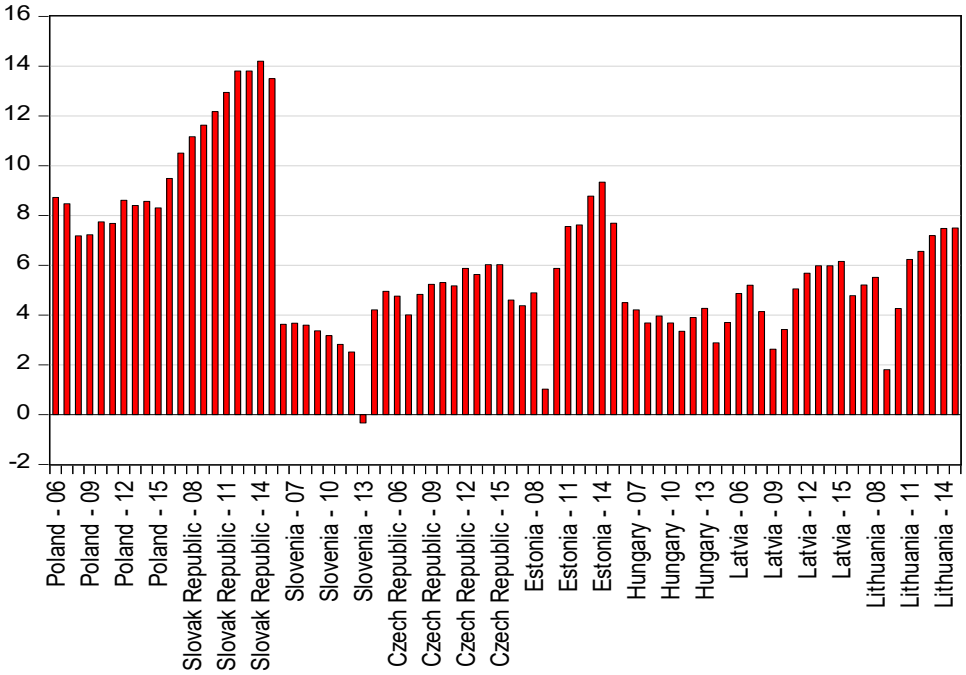
Source: Author's Computation, E-views!

Figure 3.1: Banking System Z-Score Plot (Balkans)



Source: Federal Reserve Bank of Saint Louis!

Figure 3.2: Banking Sector Z-Score Plot (CEE)



Source: Federal Reserve Bank of Saint Louis!

Non-Performing Loans (NPL)

NPL will serve to measure the impact of foreign currency loans on financial stability as it is one of the best-known indicators of financial stability. So the NPL will be used to get a second assessment from the models, thus providing additional assurance to the robustness of the results. NPL is simply calculated as the amount of non-performing loans over the total amount of outstanding loans in the banking system portfolio. High values of NPL would indicate negative signals towards stability and lower values vice versa.

When investigating the NPL through descriptive statistics, we find for the case of Balkans that it is averaged on 12.06%. This indicates that more than 12% of the loan's value will not be recovered due to borrower's failure. The median as well suggests a similar value of 11.015%. The maximum value observed in this subsample is found to be 36.65% and as it could be expected such value is associated to Greece during the sovereign debt crisis. So, in this case, NPL leads to the same conclusions as z-score before it, but while observing the data not everything matches. The display that z-score offered was indicating a high financial stability for Albania and a more instability for the rest of the region, but this does not seem to match completely with the NPL conclusions. What is being implied is that NPL data suggest that Albania is ranked second behind Greece as the country with the second highest default rate of loans. Regarding the minimum value of 2.1%, it is observed during 2007-2008 and is associated with the country of Bulgaria. A concerning picture comes from the

volatility measure of standard deviation, which suggests high volatility of this variable in the subsample.

Shifting to the second subsample of CEE, it is important to highlight that the situation is not that similar. Indeed CEE countries report a better situation when it comes to NPL. So while the z-score was indicating similar developments among the two subsamples, the NPL offers a different picture which seems to differentiate among them. The mean value is found to be 6.69% or almost half of the former subsample's mean. Also, the median is less than halved, but cases of extreme values are also present in here even though at a more moderated level with a maximum value of NPL reaching 24%. Such value, which is very concerning, is associated with the country of Lithuania. This country seems to have experienced similar situation for consecutive years as the data suggest. Disturbing developments have been observed for Latvia, Hungary, and Slovenia during the sovereign debt crisis as well. Regarding the rest of the subsample, it can be concluded that the situation has been more stable and in most of them, the financial system has been resilient. The minimum value of 0.2% has been observed prior to the global financial crisis in Estonia.

When investigating the sample in total its normal to expect higher mean, median and a higher range of values as well. Also, the standard deviation indicates an averaged volatility when subsamples are grouped together.

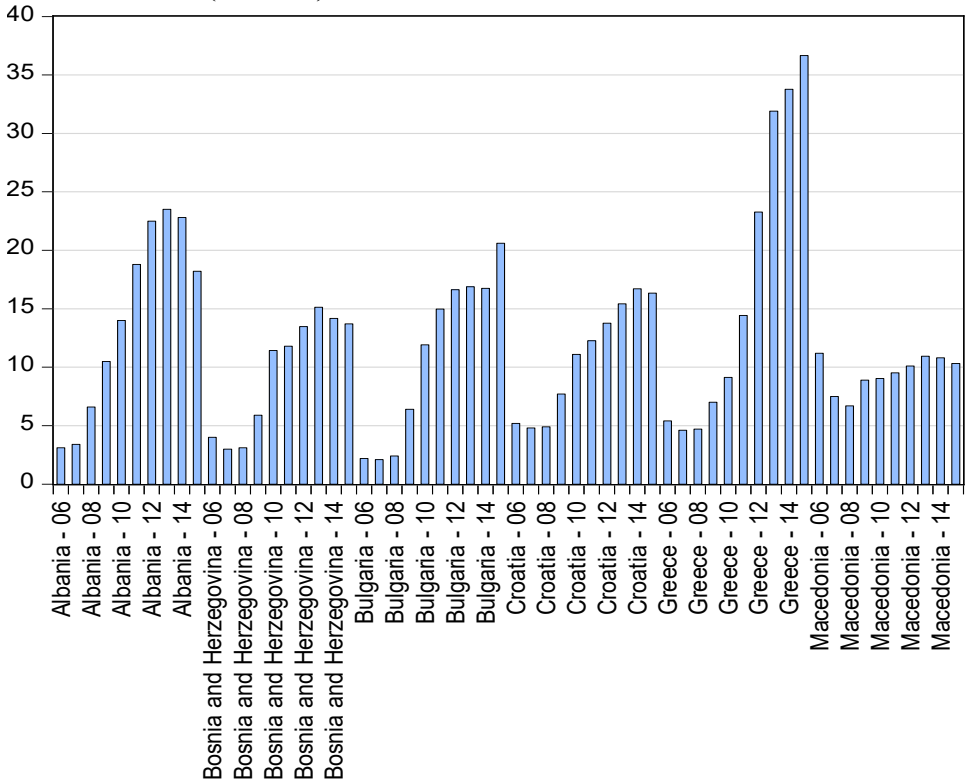
All the results of descriptive statistics are organized in table 3.2. In addition, the plots of NPL for the two subsamples are visualized separately in figures 3.3 and 3.4.

Table 3.2: NPL Descriptive Statistics

Sample	Mean	Median	Max.	Min.	S. Deviation
Balkans	12.06683%	11.015%	36.65%	2.1%	7.684011%
CEE	6.690375%	5.2%	24%	0.2%	5.2%
Balkans & CEE	8.994571%	6.25%	36.65%	0.2%	6.928839%

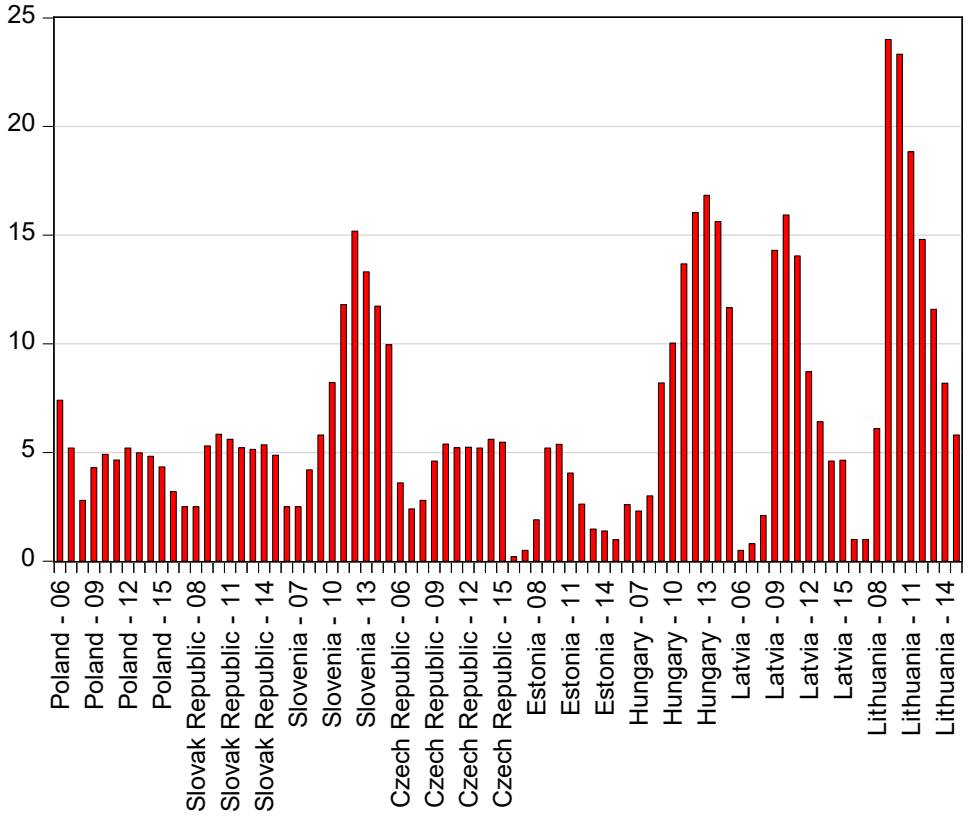
Source: Author's Computation, E-views!

Figure 3.3: NPL Plot (Balkans)



Source: Central Banks of the respective countries!

Figure 3.4: NPL Plot (CEE)



Source: Central Banks of the respective countries!

3.1.2 Independent variables

The independent or the explanatory variables used in this study are foreign currency loans –Divided into three channels-, return on assets (ROA), return on equity (ROE), inflation, lending rate and bank capital to risk-weighted assets (RWA). All of the variables are chosen based on economic theory and literature, which suggest their relevance. Of course, the purpose of this thesis is focused on the foreign currency lending and the rest of the variables are being used to avoid model remedies.

In the following table 3.3, are summarized the key descriptive statistics for each of the independent variables. Through this descriptive statistics, it is aimed to reveal certain characteristics of the sample.

Table 3.3: Dependent Variable's Descriptive Statistics (Balkans, CEE, Balkans & CEE)

	Balkans	CEE	Balkans + CEE	Balkans	CEE	Balkans + CEE	Balkans	CEE	Balkans	CEE	Balkans	CEE	Balkans + CEE
Variables	**Mean**			**Median**			**Max.**		**Min.**		**S. Deviation**		
FX Loans	78,459.76	140,409.6	113,859.7	28,414.42	7,128.392	26,703.96	510,520.8	776,480.1	1,253.067	0.000	99,122.29	219,132.8	180,023.7
HH's FX Loans	17,069.44	84,539.16	55,623.57	3,120.334	1,504.4	2,064.6	115,028.7	564,077.7	52.69820	0.000	27,730.46	152,107.8	120,826.0
Non-Fin. Corp. FX Loans	55,595.18	52,406.56	53,773.11	21,453.69	6,848.483	19,839.97	390,273.9	212,076.4	911.5379	0.000	73,478.45	67,455.47	69,859.23
Gov. FX Loans	5,795.14	3,463.903	4,463.005	13.9925	114.2052	49.8	55,247.3	44,862.6	0.000	0.000	14,509.44	8,876.712	11,639.71
ROA	0.439667%	0.6605%	0.56585%	0.815%	0.975%	0.93%	2.53%	4.24%	-8.52%	-5.98%	1.7013%	1.5582%	1.618858%
ROE	4.746667%	5.521%	5.18914%	6.195%	10.06%	8.575%	33.23%	38.47%	-85.06%	-117.67%	16.149%	21.692%	19.44976%
Inflation	2.492717%	2.951218%	2.75471%	2.325615%	2.652875%	2.450776%	12.34877%	15.43052%	-1.7359%	-1.0706%	2.6654%	2.9394%	2.824539%
Lending Rate	9.202749%	7.241949%	8.08229%	8.971350%	6.395%	7.73%	14.09962%	20.95%	5.69%	2.98%	1.8898%	3.0592%	2.789865%
Cap. to RWA	16.307%	15.23788%	15.6960%	16.4%	14.12%	15.705%	22.18%	35.65%	9.57%	10.2%	2.7426%	4.2386%	3.699417%

The variable of "FX Loans" stands for the total amount of loans in all three channels. In addition, the variables of "HH's FX Loans", "Non-Fin. FX Loans", and "Gov. FX Loans", respectively stand for foreign currency loans granted to households, non-financial corporations and government. Moreover, it is important to highlight that the foreign currency loans have been converted to a common currency, which is "Euro", and the table values are in "millions of Euro". The following variables respective to the table's listing stand for return on assets, return on equity, inflation, lending rate and bank capital to risk weighted assets. All these secondary variables are unadjusted and represented in normal percentage form.

Source: Author's Computation, E-views!

Foreign Currency Loans

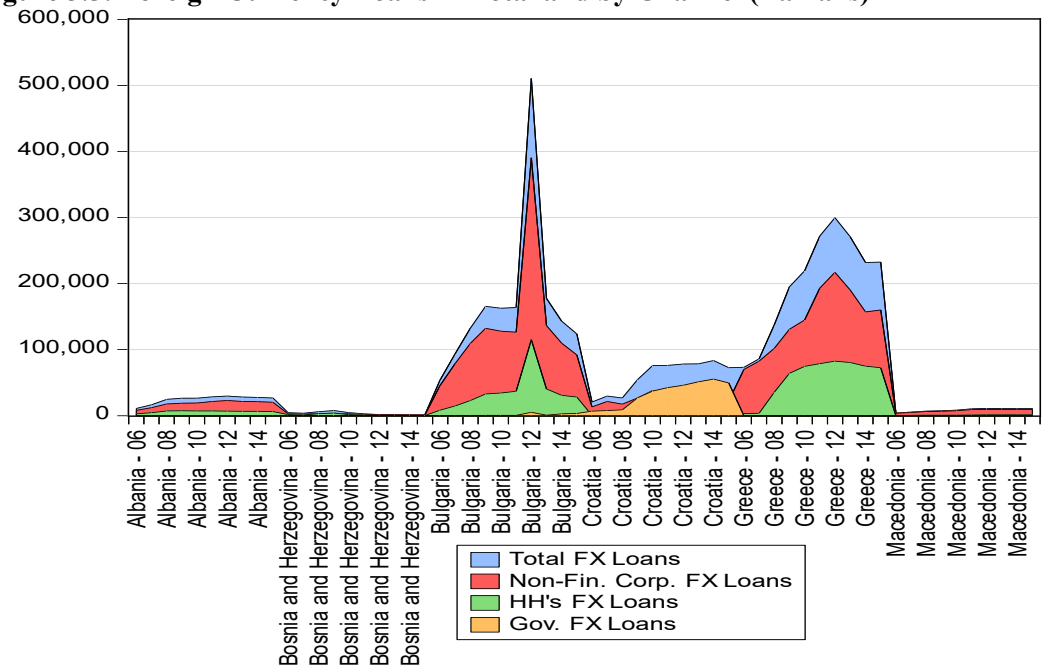
Loans issued in foreign currency for sure comprise and represent a significant amount of money which is channeled in form of loans intended for households, non-financial corporations and for the government as well. According to the descriptive statistics, foreign currency loans on total are averaged on EUR 78,459.76 million for the Balkans subsample, on EUR 140,409.6 million for the CEE subsample and on EUR 113,859.7 million for the entire sample. In addition, the median for each of the respective samples is found to be EUR 28,414.42, EUR 7,128392 and EUR 26,703.96 million. Moreover, the maximum values are found to be EUR 510,520.8 million for the case of Balkans and EUR 776,480.1 million for the case of CEE. The minimum values, on the other hand, are respectively EUR 1,253.067 million and EUR 0.000 million, indicating a very wide range, which is also reflected in the volatility measure.

When broken down by channel, it becomes obvious that the two main dominant channels are definitively households and non-financial corporations. Even though there is a part of foreign currency lending, which is concentrated in government's hands, this does not constitute a significant part of the portfolio. Back to the two main channels, it is important to highlight that the developments are different when it comes to comparing the Balkans with the CEE. In the former one, it is obvious from the mean value that the non-financial corporation loans represent a far larger amount than the household loans, while in the latter case the distribution seems to be carried out evenly. Moreover, the subsample of Balkans offers an interesting picture as among the countries within can be noticed significant differences. Countries like Bulgaria, Croatia, and Greece, seem to have larger amounts of foreign currency loans compared to countries like Albania, Bosnia and Herzegovina and Macedonia. Such outcome is to some extent strange as for example both Croatia and Albania have restrictive policies in terms of foreign currency lending and again the difference is quite substantial.

Similar differences can be also observed in the CEE subsample, which to some extent can even be more dramatic with Poland leading ahead, and Hungary, Lithuania and Latvia following after. Countries like Slovak Republic, Czech Republic, and Slovenia are far behind compared to the former mentioned group. Still, such differences may tell much or little when it comes to country-specific analyses, as figures should be understood in proportion to the country's financial system. Again, like the former case of Croatia and Albania, the same situation can be observed in the CEE countries. Even though Poland, Hungary, and Latvia are subject to foreign currency lending discouraging

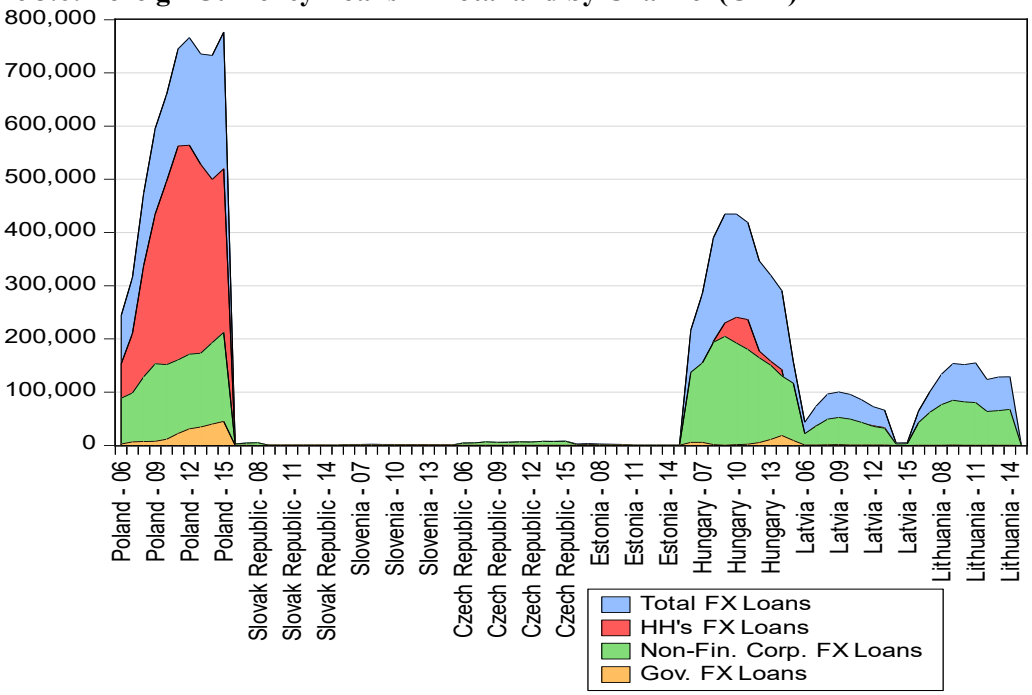
policies, their numbers are still quite high and distanced from the other countries in the sample.

Figure 3.5: Foreign Currency Loans in Total and by Channel (Balkans)



Source: Central Banks of the respective countries!

Figure 3.6: Foreign Currency Loans in Total and by Channel (CEE)



Source: Central Banks of the respective countries!

ROA

Return on assets measures the return for each euro invested in assets. According to the statistics, it represents similar developments for both Balkans and CEE countries. Its mean values are found to be 0.44% and 0.66%, with respective median values of 0.97% and 0.93%. So what these numbers suggest is that in terms of return on assets both subsamples represent similar behavior. In addition, even when joined together the results do not change significantly. Moreover, the maximum value and minimum values, which are respectively 2.53%, -8.25% for the Balkans and 4.24%, -5.98% for the CEE, indicate a large variation. Such variation is also captured by the high values of standard deviation. The countries with the poorest performance can be identified as Bosnia and Herzegovina, Bulgaria and Greece for the Balkans subsample, while from the CEE subsample the most problematic ones have been Slovenia, Latvia, Lithuania, Hungary, and Estonia. Such observation indicates low profitability in these countries.

ROE

Return on equity measures the return for one euro invested in equity and is classified among the profitability measures. From the descriptive statistics table, it is easily observable that even in terms of ROE the developments are similar as mean values for Balkans and CEE are respectively 5.52% and 5.18%. Moreover, the median values are found to be 10.06% and 8.57% respectively, while the maximum values amount at 33.23% and 38.4%. Interesting are the minimum values, which indicate that the worst periods of profitability are observed during the global financial crisis and the sovereign debt crisis. From the Balkans' side can be easily identified that the worst performer in this aspect is Greece, with a negative ROE reaching more than -85% during the sovereign debt crisis, while the rest have significantly better performance. CEE, on the other hand, has several countries with negative ROE and very poor profitability like Slovenia, Estonia, Hungary, Latvia, and Lithuania. Regarding the rest of the countries in both subsamples, can be easily concluded that their performance is very satisfactory.

Inflation

Inflation concerns were thought to be over as for many years central banks have been able to shoot at the target of 2% with an allowable band of fluctuations at +/- 1%. Unfortunately, while inflation after 2000 was maintained under control, the fear of deflation stroke with the occurrence of the global financial crisis and sovereign debt crisis as well. According to the descriptive statistics, both Balkans and CEE have been

above the target on average, thus indicating no such concerns as deflation. But the minimum values, on the other hand, indicate that inflation has been as low as -1.73% in Greece and as low as -1.07 in Latvia. Both of these values were encountered during the sovereign debt crisis and immediately recovered in the following periods. Moreover, the last two years of the sample, respectively 2014 and 2015, represent a negative inflation rate for the majority of countries in the subsample, thus making deflation a recent concern. Interesting as well is the overshooting measured by maximum value, which reach the value of 14.09% for the country of Bulgaria just prior to the global financial crisis and 20.95% for the country of Latvia in the same period. Clearly such values have been quite problematic and apparently, the occurrence of the crisis has contributed by normalizing the level of inflation.

Lending rate

Lending rate is another indicator with explanatory power for the financial situation within a country. Its behavior is impacted by the level of risk within a market and it is positively correlated with risk. So higher level of lending rate represents more risk in the financial system and as a result higher cost of borrowing. In terms of such measure can be said that the Balkans represent a more frustrated financial market with lending rate averaging on 9.2%, compared to 7.2% in CEE. On the other hand, while observing the maximum value of 14.06% for Balkans and 20.95% for CEE it becomes more clear that there are certain problematic countries in both subsamples which may influence the mean results. Apparently while observing the data, it can be easily identified that in the Balkans subsample Albania leads with the highest rate, but it is closely followed by the rest. On the other hand, CEE is more dispersed as Latvia's rate is substantially higher compared to the rest.

Bank Capital to Risk Weighted Assets

This ratio serves to measure the level of capitalization within a banking system. It is calculated based on the total level of capital and risk-weighted assets within a country, which is multiplied by their respective bank's weight. Such ratio suggests that higher values are associated with a well-capitalized financial system, which is prone to risk, thus making the system more resilient. Low values, on the other hand, tend to reveal fragile financial systems, which if face a crisis would likely collapse. Due to the fact that it is a very relevant measure, regulatory activities have imposed several rules that the banks must follow regarding such measure. While observing the mean values for

Balkans and CEE it is obvious that they are well-capitalized, with values exceeding 15%. In addition, the maximum values suggest that certain countries are very well-capitalized, thus leading to doubtful interpretations regarding huge amounts of unused financial resources. The minimum values, on the other hand, represent the countries which have consumed or have been unable to raise capital through the sample period. Interesting is the fact that all of the countries in CEE subsample have followed an increasing trend when it comes to this measure. While when it comes to Balkans, the situation seems to be more consistent, except Greece which behaves as an outlier.

3.2 Variable's Testing

This subsection will provide information on stationarity and multicollinearity issues that may be encountered with the data. In the sections below the variables will be subject to several tests and analyses.

3.1.3 Stationarity

In order to test for stationarity, there will be used the Im, Pesaran and Shin W-stat, Fisher ADF and Fisher PP. All the stationarity tests used in this subsection have a common null hypothesis, which states that there is a unit root, thus meaning that the data are not stationary. The results from the formerly mentioned tests are summarized in table 3.4 and the table is organized by providing the outcome for each of the samples.

According to the z-score p-values presented in the table, each of the stationarity tests rejects the presence of unit roots for the case of Balkans and Balkans and CEE as the values stand below 5% level of significance. On the other hand, not the same conclusion can be drawn for the case of CEE, which fails to reject the presence of unit roots by any of the tests. But the situation differs with the NPL, which successfully rejects the presence of unit roots for the case of CEE and CEE and Balkans, but fails to reject the null for the Balkans sample alone. Meanwhile, when estimating the test with a constrained number of lags even the latter one turns out to be stationary.

Moving forward, foreign currency loans as a total are found to be stationary only under the Balkans case as suggested by ADF (Augmented Dickey-Fuller) Fisher and PP Fisher tests, while in all the other case fails to reject the presence of unit roots. When broken down by channel the pieces of evidence are mixed as households loans are only stationary for the Balkans case and CEE and Balkans together. In addition, non-financial

corporation foreign currency loans are stationary only under the PP (Pearson) Fisher test for the case of Balkans and Balkans and CEE together. Regarding the third channel, the ADF Fisher results suggest stationarity only under CEE and Balkans and CEE together. The measures of profitability, on the other hand, ROE and ROA, are found to be significant in almost all subsamples, except ROA for the case of Balkans.

The rest of the variables clearly contain unit roots as each of the tests produced very high p-values. This could be expected on such measures as the fluctuation band is tighter due to their specifications. As a result, previous period's observations are supposed to have a very significant role in determining the coming period's values. When conducting the tests by constraining the number of lags to two, all these additional explanatory variables turn out to be stationary.

Table 3.4: Unit Root Tests

Variables	Test	Balkans	CEE	Balkans & CEE
Z-Score	Im, Pesaran and Shin W-stat	0.0190	0.3525	0.0500
	ADF-Fisher Chi-square	0.0140	0.4452	0.0506
	PP-Fisher Chi-square	0.0005	0.2125	0.0018
NPL	Im, Pesaran and Shin W-stat	0.2720	0.0019	0.0049
	ADF-Fisher Chi-square	0.2237	0.0012	0.0023
	PP-Fisher Chi-square	0.9588	0.4822	0.8432
FX Loans	Im, Pesaran and Shin W-stat	0.0538	0.6780	0.2411
	ADF-Fisher Chi-square	0.0358	0.5382	0.1194
	PP-Fisher Chi-square	0.0000	0.8228	0.0037
HH's FX Loans	Im, Pesaran and Shin W-stat	0.0000	0.6823	0.0043
	ADF-Fisher Chi-square	0.0000	0.5568	0.0011
	PP-Fisher Chi-square	0.0067	0.8586	0.1070
Non-Fin. Corp.	Im, Pesaran and Shin W-stat	0.2188	0.5927	0.3703
FX Loans	ADF-Fisher Chi-square	0.2000	0.5989	0.3724
	PP-Fisher Chi-square	0.0001	0.9950	0.0232
Gov. FX Loans	Im, Pesaran and Shin W-stat	0.5895	0.0939	0.1723
	ADF-Fisher Chi-square	0.6616	0.0277	0.0170
	PP-Fisher Chi-square	0.5722	0.0695	0.1348
ROA	Im, Pesaran and Shin W-stat	0.7526	0.0139	0.1117
	ADF-Fisher Chi-square	0.2690	0.0084	0.0134
	PP-Fisher Chi-square	0.1584	0.1034	0.0638
ROE	Im, Pesaran and Shin W-stat	0.0721	0.0321	0.0093
	ADF-Fisher Chi-square	0.0330	0.0123	0.0024
	PP-Fisher Chi-square	0.3754	0.1189	0.1498
Inflation	Im, Pesaran and Shin W-stat	0.8301	0.7975	0.8952
	ADF-Fisher Chi-square	0.9447	0.9587	0.9928
	PP-Fisher Chi-square	0.3145	0.8621	0.6882
Lending Rate	Im, Pesaran and Shin W-stat	0.9421	0.8316	0.9604
	ADF-Fisher Chi-square	0.9680	0.8712	0.9825

	PP-Fisher Chi-square	0.9893	0.7445	0.9712
Cap. to RWA	Im, Pesaran and Shin W-stat	0.6393	0.9909	0.9782
	ADF-Fisher Chi-square	0.7009	0.9878	0.9779
	PP-Fisher Chi-square	0.4231	0.9997	0.9716

This table summarizes the main results for the stationarity of the thesis variables. Each of the variables is subject to the Im, Pesaran and Shin, ADF Fisher and PP Fisher tests. The values represented in the table are the probability values. Such values are compared to the 95% significance level when determining the presence of unit roots.
Source: Author's Computation, E-views!

3.1.4 Multicollinearity

The multicollinearity issue among variables is encountered when there is a strong correlation between explanatory variables, which may disrupt the results. In order to detect such issue, it is very relevant to use a correlation matrix. Normally correlation levels exceeding 0.8 could be considered problematic.

According to the results plotted in table 3.5, there is no significant issue of multicollinearity among the variables. The correlation coefficients are generally weak and in some cases even insignificant at all. In addition, the only concern could be the correlation between ROA and ROE which is almost 0.8, but even in this case, there is not enough reasoning to concern as the variables are used separately in different models. Another case to be considered would definitively be the correlation of 0.669 between the non-financial corporation and household channels. Such outcome is slightly concerning, but unfortunately cannot be corrected as the only solution would be first differencing, thus resulting in loss of information. As a result, we are forced to carry the investigation at the expense of possible multicollinearity.

Table 3.5: Correlation Matrix

Correlation Matrix	**HH's FX Loans**	**Non-Fin. Corp. FX Loans**	**Gov. FX Loans**	**ROA**	**ROE**	**Inflation**	**Lending Rate**	**Cap. to RWA**
HH's FX Loans	1	0.669	0.403	0.010	0.003	0.011	0.023	0.185
Non-Fin. Corp. FX Loans	0.669	1	0.216	0.219	0.141	0.473	0.104	0.231
Gov. FX Loans	0.403	0.216	1	0.003	0.002	0.148	0.010	0.205
ROA	0.010	0.219	0.003	1	0.796	0.231	0.051	0.021
ROE	0.003	0.141	0.002	0.796	1	0.204	0.005	0.021
Inflation	0.011	0.473	0.148	0.231	0.204	1	0.238	0.013
Lending Rate	0.023	0.104	0.010	0.051	0.005	0.238	1	0.384
Cap. to RWA	0.185	0.231	0.205	0.021	0.021	0.013	0.384	1

Source: Author's Computation E-views!

4 Methodology

Considering that this study aims to explain the contribution of foreign currency loans in financial stability for a group of countries, it is typical to employ panel data methodologies. Based on the literature findings regarding the empirical models' relevance, this study will employ the Pooled OLS (Ordinary Least Square), FE (Fixed Effects), 2SLS (2 Stage Least Squares) and GMM (General Method of Moments) methodologies as such models have proven to be useful. Moreover, the fact that multiple models are applied to the dataset comes with the purpose of drawing robust conclusions from the data and offering various pictures.

4.1 General Framework

As it is clearly known, when speaking of panel data it is meant a mixture of cross-sectional and time series data, consisting of the repetition of cross-sectional data over time. The main aim of such models is to understand the behavior differences or heterogeneity across individual observations by taking into account the time dynamics as well.

The general framework introduced by Greene (2002) is built as follows,

$$y_{it} = x'_{it}\beta + z'_i a + \epsilon_{it} = x'_{it}\beta + c_i + \epsilon_{it}, \quad (4.1)$$

where i= 1,…,N, stands for the number of observations and t=1,…,T_i stands for the number of periods for which the variables are available. By excluding the intercept under the general framework we have K regressors at the x'_{it} and the heterogeneity in the dataset is captured by $z'_i a$. In addition, it is worth stating that this model is a classical regression and what constitutes the difference is the ability to observe z_i. In case this component would be observable than the solution would be OLS, but in case it is not observable like in most of the cases, other methods need to be applied.

Furthermore, the main goal is the estimation of partial effects consistently and efficiently,

$$\beta = \frac{\partial E[y_{it}|x_{it}]}{\partial x_{it}}.$$

In order for the partial effects to be estimated, specific assumptions need to be satisfied. The first one is the assumption of strict exogeneity,

$$E[\epsilon_{it}|x_{i1}, x_{i2}, \dots, x_{in}] = 0,$$

which strictly requires that the set of independent variables should not be correlated with the error term by any means. In addition, the second assumption to be satisfied is the mean independence,

$$\mathrm{E}[\mathrm{c_i}|\mathrm{x_{i1}}, \mathrm{x_{i2}}, \dots, \mathrm{x_{in}}] = \mathrm{a},$$

asking for the unobserved variable to be uncorrelated with the other variables.

4.2 Pooled Regression Model

This model is also known as a pooled OLS and it is build based on the assumption that the heterogeneity is observed and as a result, the model can be efficiently estimated by OLS. Its framework is as follows,

$$\begin{gathered} y_{it} = \alpha + \beta x'_{it} + \varepsilon_{it}, \mathrm{i} = 1, \dots, N, \text{and } \mathrm{t} = 1, \dots, T_i, \\ E[\varepsilon_{it}|x_{i1}, x_{i2}, \dots, x_{in}] = 0, \\ Var[\varepsilon_{it}|x_{i1}, x_{i2}, \dots, x_{in}] = \sigma_\varepsilon^2, \\ Cov[\epsilon_{it}, \epsilon_{js}|x_{i1}, x_{i2}, \dots, x_{in}] = 0 \; if \; j \neq i \; or \; t \neq s. \end{gathered} \tag{4.2}$$

If all the formerly stated requirements about the model are fulfilled than the model can be estimated by OLS, but there is also need to check if the classical assumptions[1] are met as well. Only under the satisfaction of the former conditions, the model would be efficiently estimated by OLS. The explanation of the case when pooled OLS would be definitively efficient is included in the appendix.

[1] Zero conditional mean of the error term, homoscedasticity, independence across observations and strict exogeneity.

4.2.1 Within and Between Estimators

The pooled regression model can be formulated in three different ways by making use of some exact transformations and specifications. Firstly we have the original model, which was explained in more detailed at the beginning of this section,

$$y_{it} = \alpha + \beta x'_{it} + \varepsilon_{it}. \tag{4.3}$$

Secondly, we can rewrite the original model in terms of group means,

$$\bar{y}_{i.} = a + \bar{x}_{i.}\beta + \bar{\varepsilon}_{i.}. \tag{4.4}$$

Thirdly it can be written as deviations from the group means,

$$y_{it} - \bar{y}_{i.} = \alpha + (x'_{it} - \bar{x}_{i.})\beta + \varepsilon_{it} - \bar{\varepsilon}_{i.} \tag{4.5}$$

For the original model case the moment matrices using total sum of squares, cross products and indicating the variation from the overall means, $\bar{\bar{y}}$, and $\bar{\bar{x}}$, is written as follows,

$$S_{XX}^{Total} = \sum_{t=1}^{T}\sum_{i=1}^{N}(x_{it} + \bar{\bar{x}})(x_{it} + \bar{\bar{x}})' \; and \; S_{XY}^{Total} = \sum_{t=1}^{T}\sum_{i=1}^{N}(x_{it} + \bar{\bar{x}})(x_{it} + \bar{\bar{y}}). \tag{4.6}$$

And in the second case, the moment matrices are written similarly but it is taken into account the variation of the group means around overall means,

$$S_{XX}^{Between} = \sum_{t=1}^{T}\sum_{i=1}^{N}(\bar{x}_{i.} + \bar{\bar{x}})(\bar{x}_{i.} + \bar{\bar{x}})' \; and \; S_{XY}^{Between} = \sum_{t=1}^{T}\sum_{i=1}^{N}(\bar{x}_{i.} + \bar{\bar{x}})(\bar{y}_{it} + \bar{\bar{y}}). \tag{4.7}$$

Finally, the third model moment matrices take into account the deviation from group means,

$$S_{XX}^{Within} = \sum_{t=1}^{T}\sum_{i=1}^{N}(x_{it} + \bar{x}_{i.})(x_{it} + \bar{x}_{i.})' \; and \; S_{XY}^{Within} = \sum_{t=1}^{T}\sum_{i=1}^{N}(x_{it} + \bar{x}_{i.})(y_{it} + \bar{y}_{it}). \tag{4.8}$$

From the former derivations, it is clear that,

$$S_{XX}^{Total} = S_{XX}^{Between} + S_{XX}^{Within} \; and \; S_{XY}^{Total} = S_{XY}^{Between} + and \; S_{XY}^{Within}, \tag{4.9}$$

indicating that the estimator will be decomposed as follows,

$$\hat{\beta}^{Total} = [S_{XX}^{Total}]^{-1} S_{XY}^{Total} = [S_{XX}^{Within} + S_{XX}^{Between}]^{-1} [S_{XY}^{Within} + S_{XY}^{Between}], \quad (4.10)$$

where

$$\hat{\beta}^{Between} = [S_{XX}^{Between}]^{-1} S_{XY}^{Between} \; and \; \hat{\beta}^{Within} = [S_{XX}^{Within}]^{-1} S_{XY}^{Within}. \quad (4.11)$$

From the former derivations, we can write the original estimator as follows,

$$\hat{\beta}^{Total} = F^{Between} \hat{\beta}^{Between} + F^{Within} \hat{\beta}^{Within}, \quad (4.12)$$

where

$$F^{Within} = [S_{XX}^{Total}]^{-1} S_{XX}^{Within} \; and \; F^{Between} = 1 - F^{Within}. \quad (4.13)$$

4.3 Fixed Effects Model

Unlike pooled OLS, fixed effects model implies that the heterogeneity is unobserved and correlated with the explanatory variables. So this means that in the original model,

$$y_{it} = x_{it}'\beta + c_i + \epsilon_{it}, \quad (4.14)$$

the unobserved effects, c_i, are correlated with the dependent variables,

$$E[c_i|X_i] = h(X_i).$$

Moreover, due to the fact that the conditional mean is identical across periods the equation can be rewritten as,

$$\begin{aligned} y_{it} &= x_{it}'\beta + h(X_i) + \epsilon_{it} + [c_i - h(X_i)] \\ &= x_{it}'\beta + a + \epsilon_{it} + [c_i - h(X_i)]. \end{aligned} \quad (4.15)$$

Considering that due to its construction the term in the brackets is uncorrelated with X_i, it can be simply included in the error term and the model can be defined as follows,

$$y_{it} = x_{it}'\beta + a_i + \epsilon_{it}. \quad (4.16)$$

An additional assumption regarding unobserved heterogeneity, c_i, states that the variance of such variable should be constant. All in all, the fixed effects indicate that the group differences can be captured in the constant term differences.

4.3.1 Fixed Effects Estimation by Least Squares

With y_i and X_i being the T observation for the i-th unit, i being a T x 1 column of ones, and ϵ_i being the T x 1 vector of error term then,

$$y_i = X_i\beta + ia_i + \epsilon_i. \tag{4.17}$$

Representing the former equation as a matrix form we can write it as follows,

$$\begin{bmatrix} y_1 \\ \vdots \\ y_n \end{bmatrix} = \begin{bmatrix} x_1 \\ \vdots \\ x_n \end{bmatrix} \beta + \begin{bmatrix} i & 0 & \dots & 0 \\ 0 & i & \dots & 0 \\ 0 & 0 & \vdots & 0 \\ 0 & 0 & \dots & i \end{bmatrix} \begin{bmatrix} a_1 \\ \vdots \\ a_n \end{bmatrix} + \begin{bmatrix} \epsilon_1 \\ \vdots \\ \epsilon_n \end{bmatrix},$$

or

$$y = [X\ d_1\ d_2, \dots, d_n] \begin{bmatrix} \beta \\ \alpha \end{bmatrix} + \epsilon,$$

where by d are indicated the dummy variables. We let the nT x n matrix $D = [d_1\ d_2, \dots, d_n]$ and then assembling nT rows produces,

$$y = X\beta + Da + \epsilon. \tag{4.18}$$

Such model is normally called Least Square Dummy Variable (LSDV), and considering that it is a classical regression model, no new results are needed to analyze it.

The least square estimator of beta can be written as,

$$\hat{\beta} = [X'M_DX]^{-1}[X'M_DX] = \hat{\beta}^{Within},$$

where $M_D = I - D(D'D)^{-1}D'$. More explanation on the issue is provided in the appendix.

4.4 Instrumental Variables (IV)

Initially, it is relevant to consider a dynamic panel data model with random individual effects,

$$y_{it} = \gamma y_{i,t-1} + \beta' x_{it} + \rho' z_i + a_i + \varepsilon_{it} \text{ for } i = 1, \dots, N \text{ and } t = 1, \dots, T. \tag{4.19}$$

The variable of a_i represents the unobserved effects, while x_{it} and z_i respectively stand for K_1 and K_2 time-invariant explanatory variables. Moreover, ε_{it} is the error term

for which $E[\varepsilon_{it}] = 0$ and $E[\varepsilon_{it}\varepsilon_{js}] = \sigma_{\varepsilon}^2$, for $j = i$ and $t = s$, and $E[\varepsilon_{it}\varepsilon_{js}] = 0$ otherwise. In addition, the assumptions of $E[a_i] = 0$, $E[\varepsilon_i x_{it}] = 0$, and $E[a_i x_{it}] = 0$ are imposed.

As the main idea behind the usage of instrumental variables relies on the ability to correct the endogeneity issue, it is worth stating the conditions that need to be satisfied by the chosen instruments. Firstly they must not be correlated with the error term, exogeneity, and secondly, they must be strongly correlated with the explanatory variable that they are trying to correct relevance.

When speaking of 2SLS, it is important to emphasize that it is one special case of IV. As such, it is built in two stages, where in the first one it runs an OLS regression of the endogenous variable on the chosen instruments and on the exogenous variables and saves the fitted values. The saved fitted values, on the other hand, contain the corrected variable, which is no longer endogenous. In the second stage the original regression is re-estimated, but this time with the fitted values from stage one. The resulting outcome is a reliable unbiased and efficient 2SLS estimator.

More concretely, the estimator of 2SLS can be defined as follows,

$$\hat{\beta}_{TSLS} = (X'Z(Z'Z)^{-1}Z'X)^{-1}X'Z(Z'Z)^{-1}Z'y,$$

where Z stands for the matrix of instruments, X stands for the set of explanatory variables and y stands for the dependent variable.

The IV approach for dynamic panel data was firstly introduced by Anderson & Hsiao (1982) and is structured in several steps. Firstly, we proceed by taking the first differencing of the dynamic model introduced earlier and representing it as follows,

$$(y_{it} - y_{i,t-1}) = \gamma(y_{i,t-1} - y_{i,t-2}) + \beta'(x_{it} - x_{i,t-1}) + \varepsilon_{it} - \varepsilon_{i,t-1} \quad t = 2, \dots, T. \tag{4.20}$$

Secondly, it is known that the $y_{i,t-2}$ is correlated with $y_{i,t-1} - y_{i,t-2}$ and uncorrelated with $\varepsilon_{it} - \varepsilon_{i,t-1}$. As a result it can be used as an instrument for $y_{i,t-1} - y_{i,t-2}$ and contribute to the estimation of γ by following IV approach. So, the estimators would be consistently defined as,

$$\begin{pmatrix} \hat{\gamma}_{IV} \\ \hat{\beta}_{IV} \end{pmatrix} = \left[\sum_{t=1}^{T} \sum_{i=2}^{N} \begin{matrix} (y_{i,t-1} - y_{i,t-2})y_{i,t-2} & y_{i,t-2}(x_{it} - x_{i,t-1})' \\ (x_{it} - x_{i,t-1})y_{i,t-2} & (x_{it} - x_{i,t-1})'(x_{it} - x_{i,t-1}) \end{matrix} \right]^{-1} \tag{4.21}$$

$$\times \left[\sum_{t=1}^{T} \sum_{i=2}^{N} \begin{matrix} y_{i,t-2} \\ (x_{it} - x_{i,t-1}) \end{matrix} (y_{it} - y_{i,t-1}) \right].$$

After obtaining the estimates of $\hat{\beta}_{IV}$ and $\hat{\gamma}_{IV}$, the third step would be to estimate parameter for the time invariant variable ρ for $i = 1, \dots, N$. Considering the following equation,

$$\bar{y}_i - \hat{\gamma}_{IV} \bar{y}_{i,-1} - \hat{\beta}'_{IV} \bar{x}_i = \rho' z_i + v_i, \tag{4.22}$$

with $v_i = \alpha_i + \bar{\varepsilon}_i$. Now the estimation is easily done by OLS.

Lastly, the fourth step after calculating all the estimators, it is the ability to estimate the variances as follows,

$$\hat{\sigma}^2{}_{\varepsilon} = 1/N(T-1) \sum_{t=2}^{T} \sum_{i=1}^{N} \big[(y_{it} - y_{i,t-1}) - \hat{\gamma}_{IV} (y_{i,t-1} - y_{i,t-2}) - \hat{\beta}'_{IV} (x_{it} - x_{i,t-1}) \big]^2, \tag{4.23}$$

and,

$$\hat{\sigma}^2{}_{\varepsilon} = 1/N(\sum_{i=1}^{N} \big[\bar{y}_i - \hat{\gamma}_{IV} \bar{y}_{i,-1} - \hat{\beta}'_{IV} \bar{x}_i - \hat{\rho}' z_i \big]^2 - \frac{1}{T \hat{\sigma}^2{}_{\varepsilon}}. \tag{4.24}$$

4.5 Generalized Method of Moments (GMM)

4.5.1 General Framework

We start by taking into account a dynamic panel data model,

$$y_{it} = \gamma y_{i,t-1} + \beta' x_{it} + \rho' z_i + a_i + \varepsilon_{it} \text{ for } i = 1, \dots, N \text{ and } t = 1, \dots, T. \tag{4.25}$$

The variable of a_i represents the unobserved effects, while x_{it} and z_i respectively stand for K_1 and K_2 time-invariant explanatory variables. Moreover, ε_{it} is the error term for which $E[\varepsilon_{it}] = 0$ and $E[\varepsilon_{it} \varepsilon_{js}] = \sigma_{\varepsilon}^2$, for $j = i$ and $t = s$, and $E[\varepsilon_{it} \varepsilon_{js}] = 0$ otherwise. In addition, the assumptions of $E[a_i] = 0$ and $E[a_i x_{it}] = 0$ are imposed.

GMM is also built based on the first differencing specification, which basically averages out any time invariances and heterogeneity,

$$(y_{it} - y_{i,t-1}) = \gamma(y_{i,t-1} - y_{i,t-2}) + \beta'(x_{it} - x_{i,t-1}) + \varepsilon_{it} - \varepsilon_{i,t-1} \quad t = 2, \dots, T. \tag{4.26}$$

Moreover, an additional assumption to be added in this case is the strict exogeneity of the explanatory variable x_{it}, $E[x'_{it}\varepsilon_{is}] = 0$ with $\forall(t, s)$.

Now, we define $\Delta = 1 - L$, where L stands for the lag, and also define $q_{it}_{(t-1+TK_1,1)} = (y_{i0}, y_{i1}, \dots, y_{i,t-2}, x'_i)'$ where $x'_i = (x'_{i1}, \dots, x'_{iT})$ and the orthogonal condition for each period is defined as $E[q_{it}\Delta\varepsilon_{it}] = 0$.

The formerly defined equation (4.26) can be written in matrix form as follows,

$$\Delta y_i = \gamma \Delta y_{i,-1} + \beta' \Delta x_i + \Delta\varepsilon_i, \tag{4.27}$$

$$\begin{bmatrix} y_{i2} - y_{i1} \\ y_{i3} - y_{i2} \\ \dots \\ y_{iT} - y_{i,T-1} \end{bmatrix} = \begin{bmatrix} y_{i1} - y_{i0} \\ y_{i2} - y_{i1} \\ \dots \\ y_{i,T-1} - y_{i,T-2} \end{bmatrix} + \begin{bmatrix} x_{i2} - x_{i1} \\ x_{i3} - x_{i2} \\ \dots \\ x_{iT} - x_{i,T-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_{i2} - \varepsilon_{i1} \\ \varepsilon_{i3} - \varepsilon_{i2} \\ \dots \\ \varepsilon_{iT} - \varepsilon_{i,T-1} \end{bmatrix}$$

Now the moment conditions can be represented as $E[W_i\Delta\varepsilon_{it}] = 0$, and matrix form with dimensions $\left[T(T-1)\left(K_1 + \frac{1}{2}\right)\right] x(T-1)$ as follows,

$$W_i = \begin{bmatrix} q_{i2}_{(1+TK_1,1)} & 0 & \cdots & 0 \\ 0 & q_{i3}_{(2+TK_1,1)} & & \\ & & \cdots & \\ 0 & & \cdots & q_{it}_{(t-1+TK_1,1)} \end{bmatrix}.$$

The proof on the number of lines can be found in the appendix section.

Due to the fact that now the number of moment condition exceeds the number of parameters, we apply GMM as suggested by Arellano & Bond (1991).

Next step is relaxing the assumption of exogeneity and assuming that the explanatory variable is pre-determined, $E[x'_{it}\varepsilon_{is}] = 0$ for $t \leq s$. So we obtain $E[q_{it}\Delta\varepsilon_{it}] = 0$, with $q_{it}_{(t-1+TK_1,1)} = (y_{i0}, y_{i1}, \dots, y_{i,t-2}, x'_{i1}, \dots, x'_{iT})'$. Under such situation

we have $\frac{T(T-1)(K_1+1)}{2}$ moment conditions represented as $E[W_i \Delta \varepsilon_{it}] = 0$ and matrix form of dimensions $\left[\frac{T(T-1)(K_1+1)}{2}\right] x(T-1)$ as follows,

$$W_i = \begin{bmatrix} q_{i2} & 0 & \cdots & 0 \\ (1+K_1,1) & & & \\ 0 & q_{i3} & & \\ & (2+2K_1,1) & & \\ & & \cdots & \\ 0 & & \cdots & q_{iT} \\ & & & (T-1+(T-1)K_1,1) \end{bmatrix}.$$

The proof on the number of lines can be found in the appendix section.

Moreover, like in the former case, we have more moment conditions than parameters to estimate. So regardless of the assumptions on the explanatory variables, under such circumstances, we need to use GMM to estimate $\theta = (\gamma, \beta')$ in equation (4.27).

4.5.2 GMM Estimator

In order to determine the estimator firstly, we assume that a relationship $m(y;\theta)$ exist such that, $E[m(y;\theta_0)] = 0$. The variable $\theta_0$in this case is the real value of θ. The formerly defined relation can be estimated, $\hat{m}(y;\theta)$, based on N independent samples of y_i, $\hat{m}(y;\theta) = (\frac{1}{N}) \sum_1^N m(y_i;\theta_0)$. Finally, through GMM we can find the estimator, $\hat{\theta}$, so that $\hat{m}(y;\hat{\theta}) = 0$.

Moreover, at this point, it is worth stating that for an equal number of moment equations and parameters the system is said to be just-identified. In case the number of moment equations is larger than it is necessary to minimize the criterion function as the system of equations does not have a solution. Generally, the criterion function can be represented as follows,

$$\hat{m}(y;\hat{\theta})' A \hat{m}(y;\hat{\theta}), \tag{4.28}$$

where A is a positive definite weighting matrix optimally defined as,

$$A^* = \{E[m(y;\theta_0)\, m(y;\theta_0)]'\}^{-1}. \tag{4.29}$$

From the determination of the weighting matrix, it is understood that the properties of the estimator will depend on the choice of A.

GMM will proceed by choosing the value of $\hat{\theta}$, which will minimize the following criterion function,

$$\hat{\theta} = \underset{\{\theta \in R^a\}}{ArgMin} q(y;\ \theta) = \underset{\{\theta \in R^a\}}{ArgMin} \hat{m}(y;\hat{\theta})' A^* \hat{m}(y;\hat{\theta}). \tag{4.30}$$

4.5.3 GMM for Panel Data

Returning to the equation (4.30), we need to estimate the $K_1 + 1$ of the parameters $\theta = (\gamma, \beta')'$ vector, with $T(T-1)\left(K_1 + \frac{1}{2}\right)$ moment conditions represented as below,

$$E[W_i \Delta\varepsilon_{it}] = E\left[W_i\left(\Delta y_i - \Delta y_{i,-1}\gamma - \beta'\Delta x_i\right)\right] = 0. \tag{4.31}$$

The moment conditions, $E[W_i \Delta\varepsilon_{it}]$, can be rewritten as $m(y_i,\ x_i; \theta)$, with $E[m(y_i,\ x_i; \theta)] = 0$.

The Arellano and Bond (1995) GMM estimator will be determined as follows,

$$\hat{\theta} = \underset{\{\theta \in R^{K_1+1}\}}{ArgMin} \left(\frac{1}{N}\sum_{i=1}^{N} m(y_i, x_i; \theta)'\right) A^* \left(\frac{1}{N}\sum_{i=1}^{N} m(y_i, x_i; \theta)\right), \tag{4.32}$$

with $A^* = \{E[m(y;\theta_0)\ m(y;\theta_0)]'\}^{-1}$, which can be optimally estimated as,

$$\hat{A}^* = \left[E\left(\frac{1}{N^2}\sum_{i=1}^{N} W_i \Delta\varepsilon_i \Delta\varepsilon_i'\ W_i'\right)\right]^{-1}. \tag{4.33}$$

5 Empirical Findings

5.1 Balkans

As discussed in the former chapters of literature review and dataset discussion, the foreign currency lending can be considered to some extent as a phenomenon for the case of Balkans due to their stage of development (recall Brown & De Haas (2010)). While being in front of such claim, it is important to start analyzing the relation between foreign currency lending and financial stability initially through figures and later through regression analysis.

In figure 1.B in Appendix B section can be found the three-dimensional plot of total foreign currency loans and Z-score. In addition, figures 2.B, 3.B and 4.B indicate the breakdown of foreign currency loans in accordance to the household, non-financial corporations, and government lending, in relation to the Z-score measure of financial stability. The feedback provided from these figures serves as an initial indication of what the literature already predicts in terms of the negative impact of such type of lending in the financial stability.

Starting with the total amounts plotted against Z-score, we can understand that with the increase of foreign currency lending the level of Z-score seems to be lower. In addition, there are also outliers present and the figure as well reflects the data differences among countries as their financial systems have additional domestic factors fueling instability. Recall the study by Nier, Yang, Yorulmazer, & Alentorn (2007). While, the total amounts clearly provide a complete feedback on the matter, the channels, on the other hand, provide more specific details. Among the channels, household and non-financial corporations ones seem to have the most significant pattern as all the countries in the dataset are rich in terms of these types of loans. The government channel, on the other hand, represents more dramatic differences due to the fact that there are countries in the sample with no foreign currency lending in this aspect. But of course, the initial indication in terms of relationships with financial instability is quite similar to the former cases.

While the relation of foreign currency loans with the measure of Z-score has been clarified, it would be relevant to reconsider the relation with the variable of non-performing loans (NPL) as well. Like earlier the relation is initially plotted in figures B.5, B.6, B.7, and B.8, which are respectively related to the total foreign currency loans plotted against NPL and the breakdown of total amounts according to the specific channels discussed earlier.

Similarly to the former relation, the NPL related figures represent the expected pattern of the negative impact of foreign currency lending in financial stability. This is clearly observed as with the increase of such lending there is a potential increase in the NPL ratio. Such behavior is extrapolated to the respective foreign currency channels as well, which are able to preserve the core pattern.

5.1.1 Pooled OLS

Having analyzed the relation in figures, it is relevant to discuss the empirical findings through the regression analyses. Referring to table 4.4 output in the data section, we decided to carry on the investigation by leaving the variables at their initial states as apparently the non-stationarity null was rejected by at least one of the three stationarity tests. Such feedback from the tests is very welcomed in our case as the main aim in here is to investigate the heterogeneity. Initially, we consider the pooled ordinary least squares model (OLS) and computed several regressions, which are displayed in tables B.1 and B.2 in Appendix B. In addition, the table 5.1 below represents the best performing pooled OLS models. In order to make the explanation more comprehensive, from now on we will refer to the pooled OLS model where the dependent variable is Z-score as the Z-score model and the ones where NPL is the dependent variable as the NPL model.

Starting with the best performing Z-score models, as expected the impact of household loans in Z-score is negative and strongly significant at 5% significance level across all models. To some extent, this outcome was expected due to the fact that this channel represents a very significant portion of this type of loans as indicated by Steiner (2012). Such outcome is also observed for the government related loans, which preserve their negativity across all models by remaining significant at the 5% level as well. The former findings are in the same line with the conclusions drawn in the studies by Brown, Ongena, & Yesin (2011), Brzoza-Brzezina, Chmielewski, & Niedźwiedzińska (2010). What is really surprising from this model's output is the sign of non-financial corporation

loans, which remains positive across all models and preserves its significance as well most of the time. Unfortunately, there is not much explanation of this matter in the literature and the reasons behind it require further investigation.

Moreover, another surprising finding in the model is the positive impact exhibited by NPL to the Z-score. Such impact remains positive and strongly significant across all models, thus going against the economic logic of negative relation among the two. Other variables on the other hand, such as inflation, lending rate, ROA, ROE, and capital to RWA exert a positive impact on the dependent variable. Apart from inflation's impact on the dependent variable, the rest is in the same line with the literature. Inflation's positive impact is questionable as higher inflation translates into higher prices, thus making a larger portion of the wages to go for consumption and a smaller portion for saving or credit repayment. In addition, the only relevant explanation in terms of this positive impact could be somehow related to the long-term behavior, as the wages are expected to grow in accordance with the inflation level. Recall the study by Nickell & Quintini (2003). Regarding the other variables the logic is fairly simple as higher lending rate means discouraging lending, higher profitability means smaller losses, while larger capital means more resilient financial system. Additionally, with all these significant impacts the Z-score models are able to explain more than 60% of the total variation in the dependent variable, meaning that the model is significantly explanatory.

Moreover, when shifting to the NPL models we observe the same behavior among the foreign currency loans variables and the dependent variable. So it is like mirroring the former results of the Z-score model. In addition, the same pattern is observed with the variable of non-financial corporations, which could even be considered as a characteristic of the Balkans sample. Other variables as well develop similarly across models and preserve the predefined economic intuition. Furthermore, the NPL models are able to explain more than 70% of the total variation in the dependent variable and have a very similar r–squared, meaning that the added variables do really exert a significant impact over the NPL ratio.

Table 5.1: Pooled OLS (Balkans)

Variables	Z-score Models			NPL Models		
HH's FX Loans	-1.57E-04	-1.36E-04	-1.23E-04	3.07E-04	2.78E-04	2.89E-04
	(3.95E-05)	(4.04E-05)	(4.05E-05)	(7.27E-05)	(7.32E-05)	(7.36E-05)
	***	**	**	***	***	***
Non-Fin. Corp. FX Loans	3.21E-05	2.80E-05	2.45E-05	-6.18E-05	-5.43E-05	-5.57E-05
	(1.39E-05)	(1.37E-05)	(1.37E-05)	(2.56E-05)	(2.55E-05)	(2.54E-05)
	*	*	.	*	*	*
Gov. FX Loans	-9.70E-05	-9.22E-05	-8.78E-05	1.54E-04	1.47E-04	1.12E-04
	(2.33E-05)	(2.29E-05)	(2.27E-05)	(4.47E-05)	(4.41E-05)	(5.31E-05)
	***	***	***	**	**	*
NPL	3.43E-01	3.42E-01	3.53E-01			
	(5.71E-02)	(5.59E-02)	(5.53E-02)			
	***	***	***			
Zscore				1.22	1.25	1.17
				(1.99E-01)	(1.96E-01)	(2.08E-01)
				***	***	***
Inflation	1.19E-01	7.67E-02	1.06E-01	-8.45E-01	-8.62E-01	-7.97E-01
	(1.48E-01)	(1.47E-01)	(1.45E-01)	(2.53E-01)	(2.48E-01)	(2.53E-01)
				**	**	**
Lending Rate	9.91E-01	9.57E-01	9.21E-01	-1.28	-1.24	-1.21
	(1.73E-01)	(1.70E-01)	(1.68E-01)	(3.67E-01)	(3.60E-01)	(3.60E-01)
	***	***	***	***	**	**
ROA		3.88E-01	1.10E-01	-4.56E-01	6.91E-02	1.80E-01
		(2.12E-01)	(2.65E-01)	(4.08E-01)	(5.01E-01)	(5.08E-01)
		.	.			
ROE			4.77E-02		-9.28E-02	-1.10E-01
			(2.82E-02)		(5.31E-02)	(5.50E-02)
			.		.	.
Cap. to RWA						3.43E-01
						(1.38E-01)
						***
Constant	-4.74	-4.65	-4.68	14.5	14.2	8.93
	(1.8)	(1.76)	(1.73)	(2.91)	(2.86)	(5.42)
	*	*	**	***	***	
R-Squared	0.606	0.630	0.650	0.721	0.737	0.743
Adjusted R-Squared	0.562	0.580	0.595	0.683	0.695	0.697

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

This table summarizes the best performing models with Z-score and NPL as dependent variables. In addition, the normal values in the table stand for the beta coefficients of the variable, while the values in parenthesis represent the standard errors. Clustering has been included in the model.

Source: Author's Computation!

5.1.2 Fixed Effects

Having discussed the pooled OLS model, we shift to the next step of analysis including the analyses of the fixed effects model. Like earlier, the summary of all regressions conducted for the Z-score model and NPL model can be respectively found in tables B.3 and B.4 in Appendix B, while the best performing models in table 5.2 below.

The fixed effects Z-score models provide similar output to the former case model, but it is worth stating that the level of significance is lower. Among the foreign currency loan variables, only the household one seem to be significant across all regressions by preserving a negative influence on the Z-score. In addition, government loans seem to maintain the negative trend but remain strongly insignificant. Non-financial corporation loans, on the other hand, continue their positive impact by remaining consistent, but significant at only 10% significance level. In comparison to the former model the other variables as well perform similarly, but what is easily noticed in this case is that many of them have become insignificant and as a result, the explanatory power is lower in this case. All in all, the below models have an explanatory power varying from 50% to 55% as suggested by the adjusted r-squared.

Moreover, the NPL model seems to be performing quite better compared to the former case. The impact of household and government lending remain positive on NPL, with the former variable being strongly significant at 5% significance level. The variable of non-financial corporation loans as well keeps exerting a negative impact while being significant at 5% significance level. As for the rest of the variables, the trend is quite similar, thus indicating the consistency of the results.

Table 5.2: Fixed Effects (Balkans)

Variables	Z-score			NPL		
HH's FX Loans	-4.62E-05	-4.49E-05	-4.17E-05	2.96E-04	2.79E-04	2.24E-04
	(1.79E-05)	(1.73E-05)	(1.72E-05)	(7.30E-05)	(7.04E-05)	(6.72E-05)
	*	*	*	***	***	**
Non-Fin. Corp. FX Loans	1.13E-05	1.22E-05	1.01E-05	-6.14E-05	-6.42E-05	-4.20E-05
	(6.59E-06)	(6.38E-06)	(6.44E-06)	(2.86E-05)	(2.75E-05)	(2.63E-05)
	.	.		*	*	
Gov. FX Loans	-2.10E-05	-2.07E-05	-2.53E-06	1.16E-04	1.11E-04	-378E-05
	(1.58E-05)	(1.53E-05)	(1.92E-05)	(6.94E-05)	(6.66.E-05)	(7.86E-05)
					.	
NPL	1.50E-01	1.58E-01	1.73E-01			
	(2.46E-02)	(2.41E-02)	(2.56E-02)			

	***	***	***			
Z-score				2.93	3.05	2.90
				(4.81E-01)	(4.64E-01)	(4.29E-01)
				***	***	***
Inflation	3.66E-02	5.60E-02	3.62E-02	-6.15E-01	-6.59E-01	-4.17E-01
	(5.54E-02)	(5.43E-02)	(5.50E-02)	(2.29E-01)	(2.20E-01)	(2.17E-01)
				**	**	.
Lending Rate	9.90E-04	3.49E-04	2.41E-02	-1.06	-9.52E-01	-9.71E-01
	(1.06E-01)	(1.02E-01)	(1.02E-01)	(4.42E-01)	(4.27E-01)	(3.93E-01)
				*	*	*
ROA	3.80E-01	2.49E-01	2.06E-01	-1.16	-5.83E-01	-2.47E-01
	(7.96E-02)	(9.92E-02)	(1.01E-01)	(3.93E-01)	(4.56E-01)	(4.34E-01)
	***	*	*	**		
ROE		2.26E-02	2.92E-02		-1.03E-01	-1.47E-01
		(1.08E-02)	(1.15E-02)		(4.70E-02)	(4.53E-02)
		*	*		*	**
Cap. to RWA			-1.41E-01			1.08
			(9.28E-02)			(3.55E-01)
						**
R-Squared	0.613	0.647	0.664	0.782	0.803	0.837
Adjusted R-Squared	0.515	0.547	0.560	0.726	0.748	0.786

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

This table summarizes the best performing models with Z-score and NPL as dependent variables. In addition, the normal values in the table stand for the beta coefficients of the variable, while the values in parenthesis represent the standard errors. Clustering has been included in the model.

Source: Author's Computation R-studio!

5.1.3 Models Testing for Fixed Effects, Heteroskedasticity, Autocorrelation and Cross-sectional Dependence

While having defined and computed the pooled OLS and fixed effects models it is relevant to consider which of the models performs better. In order to determine such issue, we make use of the F-Test, which tests for the presence of fixed effects. (See appendix A) The result from the tests for the entire list of available models is displayed in Appendix B under table B.5. According to the results from the tests in all of the cases, we are suggested to choose the fixed effects model over the pooled OLS. This comes as a result of null hypothesis rejection of no fixed effects presence at 5% significance level.

Moreover, we have made use of Breusch-Godfrey, Breusch-Pagan, and Pesaran Tests in order to test for the presence of autocorrelation, heteroskedasticity and cross-sectional dependence in the residuals. (See appendix A) The results of these tests are

summarized in Table B.6 in Appendix B for the entire list of both pooled OLS and fixed effects models.

Starting with autocorrelation, it must be admitted that in all of the models we are able to reject the null hypothesis of no autocorrelation in the model's residuals. As a result of low p-value from the test output, it is necessary to admit the presence of autocorrelation. The only models for which the test suggests no presence of such issue is the Z-score fixed effects model labeled as model 4 and 6 in table B.3 and model 3, 4, and 6 in table B.4 in Appendix B.

Regarding heteroskedasticity the pieces of evidence are mixed. According to the p-values, we are not able to reject the null of homoscedastic errors for both pooled and fixed Z-score models. In all these cases the p-value is greater than 5%, meaning that the residuals are homoscedastic. On the other hand, in none of the models under NPL, we were not able to conclude homoscedasticity. In addition, p-values suggest that there are enough pieces of evidence to conclude the presence of heteroskedasticity.

As for the cross-sectional dependence testing the shreds of evidence are mixed as well. According to the p-values we are able to reject the null hypothesis of no cross-sectional dependence at 5% significance level only for the pooled models 2 and 5 for Z-score and 1, 2 and 3 for NPL. While regarding the fixed effects model, the p-values suggest rejection of the null only for models 1, 2, 3 and 4 of NPL.

What these tests showed initially is the fact that fixed effects provide better performance compared to the pooled model. In addition, the models suffer from serious remedies, such as autocorrelation, heteroskedasticity and cross-sectional dependence related issues. All this indication leads to the conclusion that the standard errors of the formerly computed models are incorrect and as a result the test statistics together with the p-values are biased, thus making hypothesis testing invalid. The solution, in this case, is definitively a robust variance-covariance matrix, which will serve to correct the formerly encountered remedies and validate the results.

5.1.4 Robust Fixed Effects

As discussed in the former part of the chapter, it is necessary to draw robust conclusions from the data and that can only be done by correcting the encountered remedies. Such correction will only be done for the fixed effects models as earlier we were able to reject

the relevance of pooled effects across all estimations. Tables B.7 and B.8 in Appendix B summarizes the robust results for both Z-score and NPL fixed effects.

The first thing that draws attention when observing the new output are the increased values of standard errors, which are normally translated into a loss of significance across all variables in general. Recall from the former results that household loans were significant across all models, but now it only preserves the significance of 5% only on models 1, 2 and 4. Non-financial corporation loans as well exhibit the same thing by becoming totally insignificant across all models, while government-related loans variable remains significant only in models 1, 2 and 3.

The other variables of inflation, lending rate, ROE and ROA, which were strongly significant earlier have become insignificant as well. The only variable apart from household loans which has maintained the significance is the NPL ratio in the Z-score model.

Shifting to the NPL model the display seems to be quite different. Even though there is an apparent change compared to the former case, the significance is generally preserved. This means that this model somehow performs better than the one with Z-score. In addition, the variables of household and government loans remain strongly significant at 5% significance level, while the non-financial corporation loans variable is totally insignificant across models.

Other variables as well have not experienced any drastic change in the standard errors. The Z-score, inflation, lending rate, profitability measures and capital measure remain strongly significant at 5% significance level. Once again, the fact that these variables remain highly significant even after the re-estimation provides good credit for the relevance of this model.

5.1.5 Instrumental Variables (IV)

Having considered the basic models of pooled OLS and fixed effects for the Balkans case, it would be more relevant to shift to more advanced panel data techniques such as instrumental variables. This type of model could help to provide a better output and draw more concise conclusions from the data. The results are summarized in tables B.9 and B.10 in Appendix B, while the best performing models are displayed in table 5.3 below.

In this model, the variables of foreign currency loans are the ones suspected for endogeneity, due to the fact that a possible trend might be existing behind these types of loans. What this implies is that if former period's loans are high, even the next period's loans will tend to be high as well. This suggests a type of autoregressive process of the first order for these variables. As such it has been decided to use as instruments the first lag of household, non-financial corporations, and government loans.

Similarly to the former cases, the Z-score fixed effects models generated based on instrumental variables methodology provide a homogenous indication in terms of variable's signs. The variables of household and government loans once again are able to maintain their negative impact through the entire model estimations. In addition, in each of the cases, the significance has been preserved for the variable of household loans, while for the government loans it is found to be significant only in models 1, 4 and 5. Moreover, the non-financial corporation loans variable as well remains consistent in terms of sign and preserves its significance at 5% significance level across all models.

The variable of NPL, on the other hand, remains consistent and highly significant as well. Additionally, the same thing can be concluded for the profitability measures, which remain significant at 5% significance level. The variable of inflation, on the other hand, is able to keep its positive impact but remains highly insignificant. In addition, the lending rate seems to have transformed into negative, while remaining insignificant. Even the last variable of capital to RWA has transformed into negative and has preserved its significance, thus making its impact unclear. A possible explanation though for the latter one could be the fact that once you allocate more capital due to riskier assets, you give a signal of possible instability. Lastly, according to the adjusted r-squared measure, the models have a highly explanatory power, which varies from 50% to 55%. Such values indicate a considerable portion of Z-score variation explained by the formerly mentioned variables.

Shifting from Z-score model to NPL model, it is important to highlight that as concluded earlier this model seems to perform better than the former one. While for the sign and the impact of variables the NPL model serves as a reflection of the Z-score model. In addition, it seems to have higher explanatory power compared to the former one. The explanatory power, in this case, varies from 65% to 73% according to the adjusted r-squared measure. What are different in this output, are definitively the stronger significance of non-financial corporation loans and the loss of significance of

government loans. In addition, the variable of Z-score keeps remaining strongly significant across models, while inflation and lending rate provide mixed evidence in terms of significance. Regarding the profitability measures, only ROA loses its significance in models 5 and 6 while ROE remains significant all the time. The last variable of capital to risk-weighted assets as well is found to be positive and significant at 5% significance level.

If we would compare the instrumental variable fixed effects models to the normal ones, there are certain differences in parameters and their respective significances as well. Such differences are also transmitted into the r-square value, which changes significantly in the initial models and becomes more and more similar as we add more variables. So, all in all, we can conclude the presence of some endogeneity in these variables due to relevant changes in their respective values.

Table 5.3: Instrumental Variables Fixed Effects Model (Balkans)

Variables	Z-score Model			NPL Model		
HH's FX Loans	-6.55E-05	-6.59E-05	-6.23E-05	4.88E-04	4.67E-04	3.56E-04
	(2.54E-05)	(2.41E-05)	(2.52E-05)	(1.21E-04)	(1.15E-04)	(1.18E-04)
	*	**	*	***	***	**
Non-Fin. Corp. FX Loans	1.83E-05	2.00E-05	1.83E-05	-1.29E-04	-1.31E-04	-8.85E-05
	(8.76E-06)	(8.32E-06)	(8.99E-06)	(4.43E-05)	(4.21E-05)	(4.38E-05)
	*	*	*	**	**	.
Gov. FX Loans	-3.55E-05	-3.59E-05	-2.98E-06	1.41E-04	1.44E-04	9.68E-06
	(1.73E-05)	(1.64E-05)	(2.09E-05)	(9.35E-05)	(8.87E-05)	(1.04E-05)
	*	*				
NPL	1.31E-01	1.40E-01	1.44E-01			
	(2.49E-02)	(2.39E-02)	(2.53E-02)			
	***	***	***			
Z-score				3.27	3.56	3.38
				(6.88E-01)	(6.65E-01)	(6.13E-01)
				***	***	***
Inflation	5.29E-03	2.53E-02	1.94E-02	-4.74E-01	-5.09E-01	-3.35E-01
	(5.25E-02)	(5.03E-02)	(5.17E-02)	(2.70E-01)	(2.57E-01)	(2.49E-01)
				.	.	
Lending Rate	-1.81E-02	-1.45E-02	-1.41E-02	-1.17	-1.01	-9.09E-01
	(1.06E-01)	(1.00E-01)	(1.00E-01)	(5.37E-01)	(5.14E-01)	(4.72E-01)
				*	.	.
ROA	3.67E-01	2.27E-01	2.15E-01	-1.19	-6.21E-01	-3.48E-01
	(7.30E-02)	(8.90E-02)	(9.26E-02)	(4.72E-01)	(5.16E-01)	(4.90E-01)
	***	*	*	*		

ROE		2.40E-02	2.60E-02		-1.16E-01	-1.49E-01
		(9.64E-03)	(1.04E-02)		(5.25E-02)	(5.05E-02)
		*	*		*	**
Cap. to RWA			-4.75E-02			9.74E-01
			(1.01E-01)			(4.78E-01)
			*			*
R-Squared	0.617	0.666	0.676	0.731	0.763	0.806
Adjusted R-Squared	0.505	0.558	0.560	0.652	0.687	0.736

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

This table summarizes the best performing instrumental variables fixed effects models with Z-score and NPL as dependent variables. In addition, the normal values in the table stand for the beta coefficients of the variable, while the values in parenthesis represent the standard errors.

Source: Author's Computation R-studio! Clustering has been included in the model.

5.1.6 General Method of Moments (GMM)

While making use of GMM methodology, there are 4 main models computed for both Z-score and NPL displayed in Table B.11 in Appendix B and in table 5.4 below. In the table below are displayed only the results related to Z-score models as the NPL model, in this case, does not seem to have a good performance. Related to the instrumental variables matrix used, in the first model it is based on automatic selection of the matrix, while the second one is built based on a reduced form of instrumental variables matrix. In addition, the third one uses an instrumental variable matrix where the number of moments grows with the variables number and times per group. The last model is based on Arellano & Bond (1991) instruments.

Jumping to the results, it is important to highlight that the beta coefficients are totally different compared to the former regression models. The difference is materialized in size, sign, and significance as well. What is being implied initially in terms of size is that the coefficients are much smaller than in the former cases. In addition, there is a change in sign as now the household and government loans variables exert a positive impact, while the non-financial corporation loans exert a negative impact in all models but the one with an automatic selection of instrumental variables matrix. Moreover, it is important to state that none of the foreign currency loans variables was found to be significant across the 4 models.

Furthermore, the variable of inflation keeps exerting a positive significant impact over Z-score across the first three models and then transforms into negative when it comes to Arellano and Bond estimation. Such development is quite uncommon as during

the entire regressions techniques used earlier inflation has preserved a positive sign. Additionally, the variable of lending rate keeps being negative, thus indicating that an increase in lending rate indicates the presence of a less resilient financial system. The profitability measures, on the other hand, follow their economic intuition by remaining positive and significant as well. Interesting is the variable of capital to RWA, which earlier was encountered to be negative. The negativity was explained by the fact that high rates of capital signal instability, but as also indicated earlier, such explanation could be slightly considered peculiar. What is meant by this is that high level of capital may also indicate lack of business opportunities or unfavorable financial climate, but in the same time signals higher absorbing power in the event of a financial crisis. Lastly, the Z-score models based on GMM methodology are able to explain more than 40% of the total variation in Z-score.

Regarding the NPL model, it is important to emphasize that it develops the results in contrary to the Z-score model. What is meant by this is that NPL model continues to follow the logic of the formerly discussed results where household and government loans exert a positive impact on NPL, while non-financial corporation loans a negative impact. In addition, the rest of the variables as well behave similarly, thus preserving consistency. The reason for not discussing its results in more detail is the r-squared value, which as it can be observed in table B.11 in Appendix B is almost zero.

Table 5.4 - General Method of Moments Model: Z-score (Balkans)

Variables	Auto. Sel. of IV Matrix	Reduced Form of IV Matrix	IV Matrix where # Moments Grows with KT	Arellano & Bond (1991) Instruments
HH's FX Loans	3.10E-07	1.83E-06	8.17E-06	1.67E-06
	(1.59E-05)	(1.73E-05)	(1.46E-05)	(1.73E-05)
Non-Fin. Corp.	3.11E-07	-7.50E-07	-9.42E-07	-6.92E-06
FX Loans	(5.82E-06)	(6.20E-06)	(5.38E-06)	(6.19E-06)
Gov. FX Loans	5.32E-06	1.08E-05	4.87E-06	1.06E-05
	(1.94E-05)	(2.53E-05)	(1.25E-05)	(2.51E-05)
NPL	-3.08E-04	1.36E-04	-2.02E-04	2.39E-04
	(6.30E-04)	(2.86E-05)	(3.15E-05)	(4.98E-04)
	***	**	***	***
Inflation	1.45E-04	-7.33E-05	1.40E-04	-9.43E-05
	(2.96E-05)	(1.53E-05)	(2.18E-05)	(1.96E-05)
	***	**	***	***
Lending Rate	-8.78E-05	-7.58E-05	-1.63E-04	-9.77E-05
	(1.79E-05)	(1.58E-05)	(2.54E-05)	(2.03E-05)

	***	**	***	***
ROA	1.65E-03	1.49E-03	2.85E-03	1.47E-03
	(3.38E-04)	(3.12E-04)	(4.44E-04)	(3.064E-04)
	***	**	***	***
ROE	3.35E-02	3.46E-02	4.25E-02	3.50E-02
	(6.85E-03)	(7.25E-03)	(6.62E-03)	(7.27E-03)
	***	**	***	***
Cap. to RWA	5.81E-04	7.97E-04	7.40E-04	8.21E-04
	(1.18E-04)	(1.66E-04)	(1.15E-04)	(1.70E-04)
	***	**	***	***
Lagged Dep.	7.00E-04	3.79E-04	9.58E-04	3.96E-04
	(1.43E-04)	(7.93E-05)	(1.49E-04)	(8.24E-05)
	***	**	***	***
R-Squared	0.428	0.427	0.422	0.427
Adjusted R-Squared	-n/a-	-n/a-	-n/a-	-n/a-

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

This table summarizes the general method of moments models with Z-score as dependent variables. In addition, the normal values in the table stand for the beta coefficients of the variable, while the values in parenthesis represent the standard errors. Clustering has been included in the model.

Source: Author's Computation R-studio!

5.2 CEE

Initiating the analyses in figures, the pictures appear to provide mixed insights. When investigated in general the relation among total foreign currency lending and Z-score, it seems to indicate the negative relation as in the former case, but it is important to emphasize that there is a significantly wide range of values in the sample. Such relation seems to be significantly reflected in the variable of household loans as well. In addition, the non-financial corporation variable seems to provide a more consistent picture in terms of within the sample differences. It is important to emphasize in this case that there are quite substantial differences among countries with a large volume of loans versus countries with low volumes. Regarding the government loans variable, it is hard to extract some significant information from the picture as its contribution to the overall portion of loans seems to be quite constrained. See figures B.9, B.10, B.11, and B.12 in Appendix B in order to check the relations among foreign currency lending in general and broken down in channels with the variable of Z-score.

When the variables are plotted against the NPL ratio, the relation seems to be more visible as there is a specific increasing pattern associated with the underlying

relationship. Of course, even in here there are substantial differences in the sample, but when we break down the loans according to their respective channels we are able to see that the pattern still holds. Such pattern is more noticeable in the household and non-financial corporation related loans. In figures B.13, B.14, B.15, and B.16 in Appendix B can be seen the relations of the former variables with the NPL ratio.

5.2.1 First Difference

The sample of central and eastern European countries is expected to provide interesting feedback on the matter for the fact that it has been subject to similar investigations as suggested by the literature. Before continuing with the estimation, it is important to bear in mind the non-stationarity issue encountered with the variables of this sample in the data section in table 3.4. Almost all of the variables were found to suffer from the non-stationarity remedy as in none of the tests conducted the p-values were not smaller than 5%. As a result of such issue and due to the fact that we cannot take the logarithmic transformation of the variables, since many of them contain negative values or zero values, thus making the conversion impossible. Being aware that we are left only with the option of taking the first difference of the data and knowing that such action would remove any present heterogeneity in the data, there are two ways that will be followed. The first one will be to carry the investigation by taking the first differencing of the data and the second one will be the investigation through GMM, which is said to provide robust results even in the presence of non-stationarity. Such claim seems to have found support in the study by Blundell & Bond (1998). Additional solutions beyond the scope of this thesis are discussed in the studies by Phillips & Moon (2000), Smith (2000) and Blackburne & Frank (2007).

Similarly to the former cases, there have been estimated several models for both Z-score and NPL models. The summary of the entire results can be found in tables B.12 and B.13 in Appendix B, while the summary of best performing models is displayed in table 5.5 below.

Starting with the Z-score model under the first difference we observe a consistency in terms of a negative impact on Z-score through the variable of household loans. Such relationship, unfortunately, cannot be quantified as significant in any of the cases. Similar impact has been observed in the studies by Steiner (2012) and Fidrmuc, Hake, & Stix (2013). Unlike the former variable, the non-financial corporation and government-related loans are found to exert a positive impact on the variable of Z-score.

The only exception when the non-financial corporate loans variable exerts a negative impact over the Z-score is under model 3. In addition, in none of the cases, we could not find any of the variables significant. This outcome contradicts the findings presented by Ongena, Yesin, & Brown (2014) which claim on the relevance of non-financial corporation channel. For sure the interpretation is quite difficult in this case and the conclusions drawn from this output are less reliable because first differences have shaped the variables in a way that has undressed them from any possible heterogeneity.

Shifting to the variable of NPL ratio, it seems to have transformed to its negative impact in the first 3 models and then later returns gets back to the positive impact similarly to the Balkan's case. Additionally, it is important to emphasize that it is significant though only under the first three models and later becomes totally insignificant. The variables of inflation and lending rate as well provide mixed evidence in terms of sign and significance as well. Apparently, these variables seem to be affected by the newly added variables across the models. Regarding the profitability measures of ROE and ROA, it is relevant to conclude that they preserve their consistency across models and across samples as well. Such variables maintain a positive impact on Z-score and remain highly significant. As for the variable of capital to RWA, the impact is positive and highly significant. Recalling from the former parts of the chapter, higher level of capital provide a very strong buffer against financial stability episodes, which may trigger a financial crisis. Moreover, the below-presented models have a high explanatory power varying from 63% to 86%, as suggested by the adjusted r-squared values.

Having discussed the Z-score models and shifting to the NPL ones, it is relevant to recall from the former sample's findings that the expectations are based on mirrored results. Unfortunately, the first-differenced NPL models do not meet our expectations. The reason for such claim rests on the fact that instead of a positive impact of household loans on NPL ratio we get a negative influence and instead of a negative impact from non-financial corporate loans we get a positive impact. Such indication is completely the reverse of what was encountered earlier and what was expected to get. On the other hand, the variable of government loans provides mixed evidence as its impact is positive in the first 3 models and negative for the rest of the cases. In addition, similarly to the Z-score model none of the variables are found to be significant across the models.

Regarding the other variables, Z-score exerts a negative significant impact on NPL in the first 3 models and a positive insignificant impact thereafter. Inflation, on the other hand, preserves a negative impact on the dependent variable and remains highly significant across all models. As for the lending rate, similarly to the former case the indications are mixed with a difference in signs across models and loss of significance. The profitability measures of ROA and ROE keep being in line with the expectations as their impact remains negative, but significant only for the former one. A similar conclusion can be drawn from the capital to RWA variable, which follows the economic logic but is found to be insignificant in this case. Lastly, all in all, these models are able to explain from 15% to 29% of the total variation in NPL, which compared to the former models explanatory power is relatively smaller.

Table 5.5: First Difference Model (CEE)

Variables	Z-score Model			NPL Model		
HH's FX Loans	-9.81E-07	-1.63E-06	-2.05E-06	-7.31E-06	-4.01E-06	-5.54E-06
	(4.36E-06)	(3.16E-06)	(2.66E-06)	(1.61E-05)	(1.53E-05)	(1.46E-05)
Non-Fin. Corp.	1.79E-07	1.07E-07	2.37E-06	4.69E-05	5.25E-05	4.75E-05
FX Loans	(1.01E-05)	(7.37E-05)	(6.23E-06)	(3.71E-05)	(3.53E-05)	(3.37E-05)
Gov. FX Loans	3.10E-05	2.81E-05	2.91E-05	6.22E-05	3.32E-05	-1.22E-05
	(3.87E-05)	(2.80E-05)	(2.36E-05)	(1.42E-04)	(1.35E-04)	(1.30E-04)
NPL	2.44E-02	2.39E-02	2.71E-02			
	(3.67E-02)	(3.66E-02)	(2.24E-02)			
Z-score				-9.58E-01	-6.85E-01	2.72E-01
				(2.78E-01)	(2.81E-01)	(4.15E-01)
				**	*	
Inflation	-3.46E-04	1.17E-02	3.98E-02		-3.44E-01	-2.39E-01
	(3.69E-02)	(2.68E-02)	(2.32E-02)		(1.19E-01)	(1.20E-01)
			.		**	.
Lending Rate	7.23E-03	8.12E-03	-7.54E-04			-1.03E-03
	(4.25E-02)	(3.07E-02)	(2.60E-02)			(1.42E-01)
ROA	6.18E-01	2.19E-01	2.48E-01			-9.77E-01
	(7.13E-02)	(7.30E-02)	(6.18E-02)			(3.30E-01)
	***	**	***			**
ROE		3.34E-02	3.19E-02			
		(4.32E-03)	(3.65E-03)			
		***	***			
Cap. to RWA			1.23E-01			
			(2.37E-02)			
			***			
R-Squared	0.662	0.845	0.878	0.191	0.268	0.352

Adjusted R-Squared	0.631	0.828	0.863	0.156	0.225	0.292

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

This table summarizes the best performing models with Z-score and NPL as dependent variables. In addition, the normal values in the table stand for the beta coefficients of the variable, while the values in parenthesis represent the standard errors. Clustering has been included in the model.

Source: Author's Computation R-studio!

5.2.2 Instrumental Variables (IV)

Similarly to the case of Balkans the instrumental variable regressions are carried based on the belief that there might be some kind of endogeneity behind the main variables of interest. More concretely speaking, the variables referred to are household loans, non-financial corporation loans, and government loans. As instruments for these variables are used their first lags and the results are displayed in tables B.14 and B.15 in Appendix B for the entire list of Z-score and NPL models, while in table 5.6 below are displayed the best performing models.

Initiating the analyses with the Z-score models, we observe very unclear results in terms of their signs consistency across models. Taking into consideration the variable of household loans, it is obvious that in the first three models it is consistent to the former case discussed in the above section, but the similarity is only limited to the impact's nature. What is being implied by the new results is that both the coefficient values and the standard errors are different, thus confirming the presence of endogeneity in the data. Shifting to the last three models, the variable of household related loans is very similar in size but reflected through a positive sign. Strangely the point when the former variable changes its sign coincides with the change in sign of the variable of non-financial corporation loans as well. Such indication, which is contrary to what we have observed earlier, may serve once again as a signal for the presence of endogeneity remedy in the earlier results. Of course, it would make more sense to have had a consistency across models, but it is important to highlight that the initial number of variables in the first models is very constrained. Such constraint can be easily translated into an omitted variable bias issue, thus it is far safer to refer to the last three models as they are likely more complete. In addition, even the variable of government loans exhibits the same behavior as its counterparts. Moreover, any of the variables across models has not been found to be significant at any significance level. This finding is in the same line with the former model, but in this situation, the insignificance has grown slightly bigger.

Furthermore, when considering the NPL model we encounter more meaningful results. Apparently, it can be easily stated that there is a consistently positive impact of household loans with respect to the NPL ratio. Such impact, even though insignificant and only partly consistent with the former results, was expected for two main reasons. Firstly, the households in CEE sample represent the largest portion of foreign currency lending as discussed in the data section. Secondly, the majority of CEE countries are part of the European Union and a considerable part of them has Euro as its domestic currency. Such statement implies that there is a quite competitive credit market in terms of lending opportunities in Euro when it comes to fulfilling government or non-financial corporation needs. Having mentioned the two former variables, it is relevant to discuss their impacts on NPL ratio as well. Regarding the non-financial corporation loans, it has been concluded that from the second model and on the impact is positive. Such indication, even though insignificant, it is consistent and in the same line with the expectations. Unfortunately not the same conclusion could be drawn for the variable of government loans, which from the second model and on exerts a negative impact. From the information retrieved by the figures discussed at the beginning of the section, it is clearly known that such type of lending is not common for the countries in the sample, thus indicating the need to investigate the matter at a wider range of countries.

Even though the findings revealed the presence of endogeneity, what is clearly understood in here is the absence of a specific pattern and lack of consistency in results. Such outcome could be somehow expected due to the first differencing in the data. While first differencing would have been very suitable in the investigation of many other econometric relationships, it is not very appropriate in our case for several reasons. The first one, which was mentioned earlier as well, rests on the fact that we try to investigate heterogeneity as there are insights for a significant presence of heterogeneity in the data. Secondly, this dataset includes countries which have undergone a stage of transition in terms of changing their domestic currencies and becoming part of the European Union. Such substantial change has significantly shaped the foreign currency lending and has caused to have even zero values on specific years for specific countries. As a result, the first differencing of these variables yields hardly interpretable results, thus constituting one of the main limitations of this study.

Table 5.6: Instrumental Variables First Difference Model (CEE)

Variables	Z-score Model			NPL Model		
HH's FX Loans	5.04E-06	3.76E-06	1.36E-06	1.75E-05	1.59E-05	8.79E-06
	(6.75E-06)	(4.76E-06)	(3.99E-06)	(2.58E-05)	(2.44E-05)	(2.38E-05)
Non-Fin. Corp. FX	-1.64E-05	-1.41E-05	-5.28E-06	-1.22E-05	6.96E-05	2.38E-05
Loans	(1.92E-05)	(1.35E-05)	(1.14E-05)	(7.20E-05)	(6.86E-05)	(6.60E-05)
Gov. FX Loans	3.44E-05	2.03E-05	1.86E-06	4.02E-05	-6.93E-05	-2.45E-04
	(7.91E-05)	(5.57E-05)	(4.65E-05)	(2.69E-04)	(2.58E-04)	(2.63E-04)
NPL	3.14E-02	2.95E-02	2.98E-02			
	(4.01E-02)	(2.82E-02)	(2.34E-02)			
				-9.72E-01	-6.84E-01	3.62E-01
				(3.01E-01)	(3.05E-01)	(4.74E-01)
				**	*	
Inflation	-1.01E-03	1.05E-02	3.89E-02		-3.57E-01	-2.43E-01
	(4.06E-02)	(2.86E-02)	(2.45E-02)		(1.33E-01)	(1.36E-01)
					**	.
Lending Rate	4.29E-03	4.03E-03	-4.98E-03			-2.82E-02
	(4.85E-02)	(3.41E-02)	(2.84E-02)			(1.68E-01)
ROA	6.33E-01	2.28E-01	2.46E-01			-1.06
	(7.83E-02)	(7.67E-02)	(6.39E-02)			(3.84E-01)
	***	**	***			**
ROE		3.37E-02	3.23E-02			
		(4.45E-03)	(3.71E-03)			
		***	***			
Cap. to RWA			1.17E-01			
			(2.46E-02)			
			***			
R-Squared	0.657	0.845	0.892	0.171	0.253	0.323
Adjusted R-Squared	0.621	0.828	0.876	0.130	0.203	0.252

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

This table summarizes the best performing instrumental variables first difference regressions having Z-score and NPL as dependent variables. In addition, the normal values in the table stand for the beta coefficients of the variable, while the values in parenthesis represent the standard errors. Clustering has been included in the model.

Source: Author's Computation R-studio!

5.2.3 General Method of Moments (GMM)

Under this section, it is expected to get better insights regarding the relationship between foreign currency loans and financial stability measures as under this method the variables will be kept in their original form. This issue was discussed in the first part of the CEE section and was proposed as an additional solution to endogeneity remedy after carrying

the investigation by making use of first differenced models. There will be 4 type of models estimated for each of the cases as it was initially described in the Balkans section. The differences across models are related to the choice of instrumental variables matrix. Tables B.16 and B.17 in Appendix B summarize the results for the entire list of models computed through GMM, while table 5.7 below summarizes the results from the best performing models.

Starting with the Z-score model and analyzing the variable of household loans, it is indicated a generally positive impact on the dependent variable for all choices of instrumental variables matrix, but Arellano and Bond. In addition, in all cases, the variable was found to be insignificant. Such finding in the majority of models corresponds to the instrumental variable's finding as well, but our focus rests on the Arellano and Bond results household channel represents the biggest portion of foreign currency loans. Regarding the variable of non-financial corporation loans, it is easily noticeable that there exists a kind of consistency across models as the variable remains negative all the time. In addition, the only case when it is found to be significant is under the GMM model with an instrumental variable matrix whose moments grow with the number of variables and time per group. Moreover, the variable of government loans maintains a consistent positive sign across all models, thus being in the same line with the former models. Apart from that, it is found to be significant under the GMM models with an instrumental matrix of a reduced form and under the one where the number of moments grows with the number of variables and times per group.

Shifting the discussion to the output of NPL model, it is more than clear that the impact of the household related loans is negatively channeled to the NPL ratio, thus supporting the results of the first 3 GMM models. In addition, such output is consistent across all models but insignificant in every case. Regarding the non-financial corporation loans variable, can be easily concluded that the results are very consistent with the Z-score model's output as they look like a perfect reflection. Such outcome confirms once again the claim that this variable fuels financial instability. Additionally, it has been found to be highly significant at 5% significance level under the GMM with automatic selection and reduced form of instrumental variables matrix. Meanwhile, it was found to be significant at 10% significance level under the GMM with instrumental variables according to the Arellano and Bond estimation. While the consistency of the results is preserved for the first two variables, the same cannot be concluded for the variable of government-related loans. In the first two models in Table B.17 in Appendix B can be

seen that the output is in the same line with the expectations fueled by the Z-score model. But in the last two models, the impact transforms into positive, thus shaping the variable's influence in the same line with what the literature implies. Unfortunately, in any of the cases, this variable could not be found as significant.

Moreover, the rest of the explanatory variables follow their predicted path. All of them behave in the same line with literature's implication as are found to be significant in any case across all the estimated models. In addition, all of the Z-score models have a very high r-square value, which exceeds 80% and the NPL ones have an r-square value averaged on 19%, thus making the former model more preferred.

Furthermore, such results can be considered to some extent as the best-attained ones till now for several reasons. Firstly, it has been able to comply with the literature in a major part of them and has been able to meet the expectations derived from the data investigation. Secondly, GMM model correctly points out under Arellano and Bond instrumental variables matrix what it has been persistently implied earlier. Thirdly, this is the only estimation methodology under which it has been possible to achieve significance, even though only in some cases. Fourthly, these models significantly outperform the other ones as their explanatory power exceeds 80%, which represents a very relevant result.

Table 5.7: General Method of Moments Model (CEE)

	Z-score Model		NPL Model	
Variables	**IV Matrix where # Moments Grows with KT**	**Arellano & Bond (1991) Instruments**	**Auto. Sel. of IV matrix**	**Arellano & Bond (1991) Instruments**
HH's FX Loans	2.69E-06	-1.26E-06	-2.13E-06	-4.49E-06
	(1.93E-06)	(2.37E-06)	(1.04E-05)	(1.21E-05)
Non-Fin. Corp.	-1.13E-05	-1.55E-06	8.13E-05	6.15E-05
FX Loans	(5.41E-06)	(6.74E-06)	(3.11E-05)	(3.36E-05)
	*		*	.
Gov. FX Loans	3.34E-05	1.85E-05	-9.89E-06	4.78E-05
	(1.08E-05)	(1.90E-05)	(7.54E-05)	(9.52E-05)
	**			
NPL	-3.42E-03	-2.38E-03		
	(2.52E-04)	(1.68E-04)		
	***	***		
Z-score			-2.87E-03	-2.12E-03
			(6.80E-04)	(7.03E-04)

			**	**
Inflation	1.72E-03	1.89E-03	-2.95E-03	-1.88E-03
	(1.26E-04)	(1.33E-04)	(7.00E-04)	(6.22E-04)
	***	***	**	**
Lending Rate	-7.60E-04	-8.22E-04	1.25E-03	1.01E-03
	(5.60E-05)	(2.03E-05)	(2.98E-04)	(3.36E-04)
	***	***	**	**
ROA	2.46E-03	2.33E-03	-3.50E-03	-2.50E-03
	(1.81E-04)	(1.65E-04)	(8.31E-04)	(8.26E-04)
	***	***	**	**
ROE	4.05E-02	4.40E-02	-6.50E-02	-4.80E-02
	(2.98E-03)	(3.11E-03)	(1.54E-02)	(1.58E-02)
	***	***	**	**
Cap. to RWA	-9.91E-04	-4.59E-04	1.03E-03	4.53E-04
	(7.30E-05)	(3.24E-05)	(2.45E-04)	(1.49E-04)
	***	***	**	**
Lagged Dep.	-3.75E-04	-5.32E-04	7.97E-04	-4.09E-04
	(2.76E-05)	(3.76E-05)	(1.88E-04)	(1.35E-04)
	***	***	**	**
R-Squared	0.818	0.835	0.200	0.200
Adjusted R-Squared	-n/a-	-n/a-	-n/a-	-n/a-

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

This table summarizes the best performing general method of moments models with Z-score and NPL as dependent variables. In addition, the normal values in the table stand for the beta coefficients of the variable, while the values in parenthesis represent the standard errors.

Source: Author's Computation R-studio!

5.3 Balkans & CEE

While having discussed the subsamples of Balkans and CEE in the first two parts of the chapter, it is important to investigate and understand the entire dynamics by analyzing them under a full sample. The synergies of joining them together can be identified in the increased number of interactions, more solid conclusions can be drawn and the reliability of what empirical analyses reveals would be much higher.

Similarly to the former cases, the relation among foreign currency lending with the dependent variable of Z-score can be observed in figures B.17 for the total foreign currency lending and in B.18, B.19 and B.20 in Appendix B for the respective channels. Starting with the overall picture of total foreign currency lending and Z-score, it is obvious from the figure that an increase in the overall level of foreign currency loans is translated into lower Z-score. In addition, there is one country in the sample whose data

impact significantly the relation in the figure as it behaves as an outlier. According to the figures discussed in the data section, the relating country should be Poland as it has the highest level of foreign currency lending in the sample. When broken down into channels the relationship does not seem to differ significantly as the pattern is quite similar. The household related loans seem to have a very similar pattern to the total foreign currency lending, while non-financial corporation loans variable pictures the relation more clearly. As for the government channel, it also follows a very clear pattern indicating the negative relation with the Z-score.

When investigating the relation of the foreign currency loans with the NPL ratio, the figures reveal the patterns more clearly. For both foreign currency loans in total or only that portion related to households, the pattern is quite similar with NPL ratio increasing with the increase of the foreign currency lending. Similar patterns can be observed in the other channels as well, with a more pronounced positive relation in the government related loans. See figures B.21, B.22, B.23 and B.24 in Appendix B, related respectively to total amounts, households, non-financial corporation and government foreign currency loans.

5.3.1 Pooled OLS

Similarly to the case of Balkans alone and unlike CEE, the joint sample does not suffer from endogeneity issue. The results are plotted in table 3.4 in the data section and for each of the variables at least one out of three available test statistics is able to reject the presence of unit roots and conclude stationarity. Even for the variables of inflation, lending rate and capital to risk-weighted assets, the stationarity is ensured within the first two lag, while the results in the table represent a very high number of lags. Since stationarity is ensured we are able to continue our estimation as normally by keeping the variables to their original form and by preserving the presence of any heterogeneity in the data.

The pooled OLS results for both Z-score and NPL models can be found in tables B.18 and B.19 in Appendix B, where are summarized the entire list of regressions conducted with respect to the matter. Table 5.8 below, on the other hand, summarizes the results from the best performing models.

Unlike what was originally expected the variable of household loans exerts a positive impact on the variable of Z-score. In addition, it is found to be significant at 5%

significance level across all available models. Literature implications suggested on high presence of household loans as pointed out by Brown & De Haas (2010) and according to a study by Fidrmuc, Hake, & Stix (2013) the expectations relied on a negative relationship. There might be multiple reasons behind this result, but in order to lighten up our understanding, there are two main issues that might be causing it in this sample. The first one is related to country differences. A simple plot would easily detect the wide range of values across countries, with Poland and Bulgaria hitting the graphs on top and the Slovak Republic and Estonia, on the other hand, standing close to the x-axis. The second one is related to the ability of Z-score in capturing the negative effects of foreign currency lending. Of course, these are just insights, but a simple proof for the second one can be developed while comparing with the NPL output. Unfortunately, the values in the NPL model remain negative across models, thus rejecting our former claim on the Z-score capability of capturing foreign currency lending effects. Having rejected the second reasoning, we have narrowed the range and can point to the large sample differences for such result.

Unlike the former variable, non-financial corporation loans exert a negative impact across all models by staying in the same line with Brown, Ongena, & Yesin (2011). Such impact is at the same time consistent and significant at 5% significance level. In addition, as expected even the NPL model's results serve as a double confirmation of what we are implying. Through every single NPL model, the variable is positive and highly significant at any significance level. Moreover, the variable of government loans as well as in the same line with the literature as it maintains a constant negative impact against Z-score. Unfortunately, it is found to be significant only in a few models, but this is due to the low levels of such type of loans across each of the countries in the sample. Similar findings are concluded in the NPL model as well, with the dependent variable exerting a positive impact on NPL ratio. Again similarly to the former case, it remains insignificant in general.

As for the other independent variables, the impact and sign are in the same line with the formerly discussed results in the previous subsamples. For sure there are small issues and relevant explanation behind each of them, but further analyses would not contribute to the outcome of this study. Lastly, the Z-score and NPL models are able to respectively explain more than 30% and 45% of the total variations in the dependent variables.

Table 5.8: Pooled OLS (Balkans & CEE)

Variables	Z-score Model			NPL Model		
HH's FX Loans	6.75E-06	7.30E-06	8.29E-06	-2.47E-05	-2.52E-05	-2.58E-05
	(3.13E-06)	(3.07E-06)	(3.07E-06)	(5.35E-06)	(5.27E-06)	(5.37E-06)
	*	*	**	***	***	***
Non-Fin. Corp. FX Loans	-1.31E-05	-1.45E-05	-1.35E-05	5.18E-05	5.32E-05	5.27E-05
	(5.44E-06)	(5.35E-06)	(5.30E-06)	(8.99E-06)	(8.87E-06)	(8.92E-06)
	*	**	*	***	***	***
Gov. FX Loans	-4.08E-05	-4.15E-05	-5.46E-05	6.37E-05	6.57E-05	7.39E-05
	(2.32E-0.5)	(2.27E-0.5)	(2.32E-05)	(4.22E-05)	(4.15E-0.5)	(4.34E-05)
	.	.	*			.
NPL	1.41E-01	1.58E-01	1.59E-01			
	(4.64E-02)	(4.59E-02)	(4.53E-02)			
	**	***	***			
Z-score				4.63E-01	5.24E-01	5.43E-01
				(1.52E-01)	(1.52E-01)	(1.54E-01)
				**	***	***
Inflation	-2.00E-01	-1.88E-01	-1.09E-01	-6.74E-01	-6.51E-01	-6.92E-01
	(1.00E-01)	(9.86E-02)	(1.04E-01)	(1.75E-01)	(1.72E-01)	(1.83E-01)
	*	.		***	***	***
Lending Rate	3.09E-01	2.92E-01	2.70E-01	-6.62E-02	-6.10E-02	-5.39E-02
	(9.04E-02)	(8.88E-02)	(8.81E-02)	(1.70E-01)	(1.68E-01)	(1.68E-01)
	***	**	**			
ROA	9.93E-01	5.03E-01	4.77E-01	-1.61	-8.24E-01	-8.16E-01
	(1.72E-01)	(2.53E-01)	(2.50E-01)	(3.19E-01)	(4.63E-01)	(4.64E-01)
	***	*	.	***	.	.
ROE		5.27E-02	5.22E-02		-8.69E-02	-8.74E-02
		(2.04E-02)	(2.01E-02)		(3.73E-02)	(3.74E-02)
		*	*		*	*
Cap. to RWA			1.58E-01			-9.22E-02
			(7.39E-02)			(1.38E-01)
			*			***
Constant	3.41	3.41	0.84	7.51	6.94	8.34
	(0.89)	(0.87)	(1.47)	(1.57)	(1.56)	(2.63)
	***	***		***	***	**
R-Squared	0.290	0.324	0.347	0.470	0.491	0.493
Adjusted R-Squared	0.252	0.283	0.302	0.442	0.460	0.458

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

This table summarizes the best performing models with Z-score and NPL as dependent variables. In addition, the normal values in the table stand for the beta coefficients of the variable, while the values in parenthesis represent the standard errors. Clustering has been included in the model.

Source: Author's Computation R-studio!

5.3.2 Fixed Effects

Similarly to the former cases, the results from fixed effects Z-score and NPL models are displayed in tables B.20 and B.21 in Appendix B, while table 5.9 below summarizes the results form the best performing models among them.

Unlike pooled OLS, the fixed effects model provides dynamics which are somehow different. The variable of household loans starts by being negative in the first three models and transforms into positive thereafter. Similar to it, the variable of government loans as well exhibits a similar pattern and only returns to its negative impact after the first 3 models. In addition, both of the variables are found to be totally insignificant at any of the cases. In order to understand such behavior, it is necessary to consider every issue that might have been incurring. The most obvious and the easiest one to evaluate in our case is the issue of omitted variable bias in the first 3 models. Moreover, the presence of this issue is often characterized by a change of sign, loss of significance, change in standard errors, etc. A supporting element of such claim in the available output is definitively the negatively adjusted r-squared in the first 3 models and the change that has incurred in this value thereafter. Regarding the variable of non-financial corporation loans, the impact is fairly consistent and negative across models. But similarly to the formerly discussed variables, it is insignificant at any level.

Furthermore, unlike the Z-score model, the NPL one provides similar results to the former model. It indicates that all variables are able to maintain their originally indicated impact across every single model and under a different set of variables. In addition, the variables of household and government loans are found to be insignificant at any level. The non-financial corporation loans, on the other hand, have been able to preserve significance across all models.

Lastly, the Z-score models are able to explain on average from 40% to 55% of the total variation in the dependent variable according to the adjusted r-squared measure. The NPL models, on the other hand, have an explanatory power varying from 35% to 40% of the total variation in NPL ratio.

Table 5.9: Fixed Effects (Balkans & CEE)

Variables	Z-score Model			NPL Model		
HH's FX Loans	1.62E-06	1.52E-06	4.02E-07	-8.05E-06	-7.61E-06	-6.28E-06
	(2.52E-06)	(2.43E-06)	(2.15E-06)	(1.13E-05)	(1.09E-05)	(1.09E-05)
Non-Fin. Corp.	-2.33E-06	-1.81E-06	1.42E-06	4.80E-05	4.33E-05	3.81E-05
FX Loans	(3.54E-06)	(3.43E-06)	(3.07E-06)	(1.53E-05)	(1.49E-06)	(1.52E-05)
				**	**	*
Gov. FX Loans	-1.01E-06	-1.54E-06	-1.76E-06	7.11E-06	9.26E-06	3.40E-05
	(1.47E-05)	(1.43E-05)	(1.28E-05)	(6.63E-05)	(6.43E-05)	(6.59E-05)
NPL	7.44E-02	8.44E-02	7.85E-02			
	(1.92E-02)	(1.89E-02)	(1.67E-02)			
	***	***	***			
Z-score				1.49	1.70	2.02
				(3.87E-01)	(3.82E-01)	(4.30E-01)
				***	***	***
Inflation	-1.19E-01	-1.14E-01	3.73E-03	-4.27E-01	-3.83E-01	-5.15E-01
	(3.68E-02)	(3.57E-02)	(3.72E-02)	(1.68E-01)	(1.63E-01)	(1.83E-01)
	**	**		*	*	***
Lending Rate	-4.24E-02	-3.52E-02	-5.75E-02	-3.67E-01	-3.60E-02	-3.06E-02
	(4.62E-02)	(4.48E-02)	(3.96E-02)	(2.05E-01)	(1.99E-01)	(2.01E-01)
				.	.	
ROA	6.33E-01	4.38E-01	4.15E-01	-2.00	-1.22	-1.31
	(6.60E-02)	(9.06E-02)	(7.99E-02)	(3.48E-01)	(4.32E-01)	(4.33E-01)
	***	***	***	***	**	**
ROE		2.24E-02	2.35E-02		-9.75E-02	-1.05E-01
		(7.45E-03)	(6.56E-03)		(3.36E-02)	(3.37E-02)
		**	***		**	**
Cap. to RWA			1.93E-01			-2.93E-01
			(3.26E-02)			(1.86E-01)
			***			
R-Squared	0.489	0.525	0.635	0.468	0.504	0.514
Adjusted R-Squared	0.403	0.441	0.567	0.379	0.416	0.423

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

This table summarizes the best performing models with Z-score and NPL as dependent variables. In addition, the normal values in the table stand for the beta coefficients of the variable, while the values in parenthesis represent the standard errors. Clustering has been included in the model.

Source: Author's Computation R-studio!

5.3.3 Models Testing for Fixed Effects, Heteroskedasticity, Autocorrelation and Cross-sectional Dependence

This section performs several tests over the formerly computed models. The aim, in this case, is the provision of robust results and to ensure that the drawn conclusions are

reliable. Such analyses will be conducted by making use of F-Test to test for fixed effects, Breusch-Godfrey for autocorrelation, Breusch-Pagan for heteroskedasticity and Pesaran test for cross-sectional dependence.

Starting with the F-Test results, which are displayed in table B.22 in Appendix B, the null hypothesis states no presence of fixed effects, thus pointing pooled OLS as a better model. According to the p-value results in each case, we are able to reject the null hypothesis as the values are lower than 5%. This means that we have enough evidence to conclude that the fixed effects models are better than pooled OLS ones in every case.

Regarding Breusch-Godfrey test for autocorrelation, the results are displayed in table B.23 in Appendix B. The null hypothesis states that there is no autocorrelation in the residuals. According to the p-values produced by the former mentioned test, we have enough evidence to reject the null at each of the cases at 5% significance level. This means that basically all of the estimated models suffer from the autocorrelation issue.

Moreover, the results of Breusch-Pagan test for heteroskedasticity are displayed in table B.23 in Appendix B. The null hypothesis, in this case, indicates no presence of such remedy in the residuals. According to the p-values, in all of the cases, we have enough evidence to reject the null hypothesis of homoscedasticity. As a result, we can conclude the presence of heteroskedasticity in all the models.

Furthermore, the Pesaran test results for cross-sectional dependence are displayed in table B.23 in appendix B. The null hypothesis, in this case, states that there are no cross-sectional dependencies. According to the p-values results, we are able to reject the null for all cases of pooled OLS models. While for the fixed effects, the null can only be rejected for models 4 and 5 where Z-score is the dependent variable and models 1, 2 and 3 where the NPL ratio is the dependent variable. In all the other cases there is no presence of such issue.

5.3.4 Robust Fixed Effects

In the former section of the chapter, it was clearly concluded that there are several issues associated with the previously estimated models. Remedies such as autocorrelation, heteroskedasticity, etc. seriously impact the output of the model by making the hypothesis testing unreliable through influencing the standard errors. In order to correct for this issue, similarly to the case of Balkans we will make use of a heteroskedasticity and autocorrelation robust variance-covariance matrix. Through such re-estimation, it

will be possible to retrieve the correctness of standard errors and as a result, validate the hypothesis testing. In addition, the robust variance-covariance matrix will only be applied to the fixed effects models, since in all of the cases we have been able to reject the null of pooled OLS. The results are displayed in tables B.24 and B.25 in appendix B.

Initially what drags attention are the significant changes in the values of standard errors. There are cases when the value has changed by becoming lower and more concretely this is related to household and government foreign currency loans. Unfortunately, apart from the latter variable turning significant at 5% significance level, the rest has remained insignificant again. In addition, the same has happened with non-financial corporation loans variable, but there was no gain in significance. Significant differences can be observed in the NPL model as well, since standard errors values have increased. Such increase has caused the non-financial corporation loans variable to lose significance and the other variables to become more insignificant as well. As for the other explanatory variables, there is a relevant change but due to the fact that many of them used to be significantly earlier at less than 1% significance level, no substantial loss could be observed.

5.3.5 Instrumental Variables (IV)

Similarly to the former cases, even in here the variables of household, non-financial corporation, and government foreign currency loans are suspected to suffer from endogeneity. In order to correct for such remedy, we will make use of instrumental variables technique and will use the first lags of the formerly mentioned variables as instruments. Such choice comes due to the fact that foreign currency lending follows a consistent trend across periods. Having stated this claim, it is important to explain that such statement holds as practice has shown that financial and economic situation fueling such phenomenon rarely changes drastically.

The instrumental variables models are estimated for both Z-score and NPL dependent variables. In addition, only the fixed effects models are estimated as it has been already clarified from the former analysis in upper parts of the section that fixed effects are preferred over pooled OLS. Moreover, the results for all the instrumental variables regressions are summarized in tables B.26 and B.27 in Appendix B, while table 5.10 below displays the results of the best performing models.

Jumping to the analyses, there are two main important things noticed by viewing the general results. The first one is related to the positive impact of household loans on the dependent variable of Z-score. In addition, it is consistent across all models but at the same time, it is insignificant. Secondly, this variable keeps maintaining the same impact even in the NPL models, as the beta coefficients look like a perfect reflection of the Z-score models. But similarly to the former model, even in here the variable is found to be insignificant across all models. When shifting to the non-financial corporation loans variable the impact is totally reversed. It is negative and consistent across all Z-score models, thus indicating that the main source of instability originates from this type of loans. Unfortunately, in none of the cases, it could not be found significant at any level. While considering the NPL models, the relation nature is still preserved. The impact of such variable is positive over the NPL ratio and at the same time consistent across all models. In addition, it is also significant in all the models at 5% significance level and significant at 10% only in model 6. The variable of government loans on the other hand provides mixed evidence as it initially exerts a positive impact on Z-score. Such impact is in contrary to our former findings and to the expectations as well, but probably the sign is influenced by the omitted variable bias presence as it was only faced in the first model. For the rest of the models this variable is able to preserve its negativity towards Z-score, but still could not be found significant in any of the cases. When comparing these results with the ones in NPL models, it is concluded a general consistency in terms of impacts. In 90% of the cases, government loans variable exerts a positive impact over the NPL ratio, thus mirroring the former model's results. Unfortunately similarly to the Z-score models in none of the cases could be found significant.

The rest of the variables follow basically the same trend as in the former cases, thus remaining consistent. In addition, they are generally significant at 5% significance level and many times even at 1% significance level. Their inclusion improves the model's performance and provides a better picture of the results. Such contribution is translated into high explanatory power in all models, varying from 45% to 65% in Z-score models and from 30% to 36% in NPL models as suggested by the measure of r-squared. Moreover, the fact that the measure of r-squared is quite similar to the adjusted r-squared is a good indicator of the relevance of such variables.

All in all, the instrumental variables models indicate that there is some presence of endogeneity in the variable. Such indication is reflected in the change of values of beta

coefficients and standard errors as well. The first lags used as instruments seem to be quite relevant in this case, but of course, other variables can be considered as well.

Table 5.10: Instrumental Variables Model (Balkans & CEE)

Variables	Z-score Model			NPL Model		
HH's FX Loans	5.47E-06	4.96E-06	2.55E-06	-1.57E-05	-1.43E-05	-1.03E-05
	(3.47E-06)	(3.26E-06)	(2.84E-06)	(1.76E-05)	(1.71E-05)	(1.69E-05)
Non-Fin. Corp.	-6.60E-06	-5.28E-06	-2.79E-07	5.64E-05	4.98E-05	3.93E-05
FX Loans	(4.31E-06)	(4.05E-06)	(3.60E-06)	(2.11E-05)	(2.06E-05)	(2.11E-05)
				**	*	.
Gov. FX Loans	-1.23E-05	-1.29E-05	-2.77E-05	-2.04E-07	4.27E-06	3.92E-05
	(1.60E-05)	(1.50E-05)	(1.31E-05)	(8.15E-05)	(7.90E-05)	(8.02E-05)
			*			
NPL	5.53E-02	6.57E-02	6.43E-02			
	(1.87E-02)	(1.77E-02)	(1.53E-02)			
	**	***	***			
Z-score				1.36	1.75	2.23
				(4.82E-01)	(4.91E-01)	(5.52E-01)
				**	**	***
Inflation	-1.23E-01	-1.18E-01	-1.78E-03	-4.47E-01	-3.77E-01	-5.50E-01
	(3.42E-02)	(3.21E-02)	(3.41E-02)	(1.79E-01)	(1.76E-01)	(1.98E-01)
	***	***		*	*	**
Lending Rate	-6.68E-02	-5.93E-02	-6.80E-02	-3.95E-01	-3.67E-01	-3.07E-01
	(4.45E-02)	(4.17E-02)	(3.60E-02)	(2.25E-01)	(2.19E-01)	(2.18E-01)
			.	.	.	
ROA	6.33E-01	4.15E-01	3.91E-01	-1.83	-1.20	-1.34
	(6.06E-02)	(7.99E-02)	(6.91E-02)	(4.03E-01)	(4.57E-01)	(4.56E-01)
	***	***	***	***	**	**
ROE		2.55E-02	2.52E-02		-9.60E-02	-1.06E-01
		(6.62E-03)	(5.71E-03)		(3.61E-03)	(3.60E-02)
		***	***		**	**
Cap. to RWA			1.88E-01			-3.97E-01
			(3.21E-02)			(2.20E-01)
			***			.
R-Squared	0.558	0.616	0.716	0.413	0.453	0.474
Adjusted R-Squared	0.474	0.539	0.656	0.301	0.342	0.362

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

This table summarizes the best performing instrumental variables first difference regressions having Z-score and NPL as dependent variables. In addition, the normal values in the table stand for the beta coefficients of the variable, while the values in parenthesis represent the standard errors. Clustering has been included in the model.

Source: Author's Computation R-studio!

5.3.6 General Method of Moments (GMM)

Similarly to the former cases even for the Balkans and CEE sample together will be applied the general method of moments as a more advanced and reliable method. Again in here will be four main models distinct by the choice of instrumental variables matrix. The options of the instrumental variable matrix are based on automatic selection, reduced form, moments growing with the number of variables and time per group, and lastly based on Arellano and Bond. Such results are summarized in Table B.28 in Appendix B, while in the table 4.11 below are displayed the best performing models.

Starting with the Z-score models, it is directly obvious that the results present a different panorama of what we used to see earlier. Such contradiction to the former results strives across all three channels of foreign currency lending. Recalling from the former sections, household foreign currency loans used to exert a constant positive impact over the dependent variable of Z-score. Unfortunately, such consistency is broken down when we analyze the output of GMM models. Regardless of the instrumental variables matrix selection, the results match by coming together at a single point and suggesting a negative impact of this variable on Z-score. For sure this is totally supported by economic logic and literature findings as this kind of loans comprise a significant portion of foreign currency lending in each of the countries in the sample. Additionally, when considering the NPL models results and contrast them with the Z-score models result, we are able to conclude consistency. In each case, the household foreign currency loans are found to exert a positive impact on the variable of NPL. Unfortunately in none of the models could not be found any significant result for this variable. Moreover, the NPL models are to some extent questionable as their explanatory power is very low, averaged on less than 7%.

While for sure the former variable's developments across different methods were surprising, the non-financial corporation loans variable as well provides new insights. In each of the Z-score models, this variable is found to exert a positive impact on the dependent variable. Such impact is consistent across a different selection of instrumental variable matrix and contrasts the previous findings for this variable. Formerly, the non-financial corporation loans variable was the only one maintaining a consistent negative approach towards Z-score, while in this case, the situation has turned upside down. When we try to support these findings by comparing with the NPL models, the results are again tricky and different. The difference is constituted in terms of impacts as this variable positively impact NPL ratio, thus indicating a pure contribution to financial

instability. On the other hand, it is tricky as the outcome is totally contrary to what Z-score models predict. In addition, even though the NPL models are consistent with the earlier empirical analysis findings, the results are weak and questionable. The former claim is based on the insignificance of the variable in any case across the models and on the low explanatory power of NPL models.

Furthermore, the variable of government loans as well represents homogenous dynamics to its counterparts. Unlike earlier, the GMM output reveals a positive approach of this variable towards the Z-score. Such impact could be explained to some extent with the low volume of these types of loans and their low contribution to the banking portfolio. But even though expected, it is doubtful due to the consistency of a negative impact in the former analyses. While contrasting the Z-score models with the NPL ones, it is obvious that the latter ones result in display different dynamic. The NPL models in each of the cases indicate a positive impact of this variable in the NPL ratio. Again like discussed in the former paragraphs, the credibility and robustness of such results are questionable. Under the Z-score models, the government loans variable was found to be significant only when the instrumental variable matrix included an increasing number of moments with the increase in variables and time per group. Regarding the significance of NPL models, in all cases, the variable was found to be insignificant.

As per the other variables, the output is quite consistent with the former findings. The main update, in this case, would be considered the negative impact of NPL on Z-score and the vice versa. In addition, all of the other variables are highly significant at any significance level. Moreover, the Z-score models are able to explain up to 70% of the total variation in the dependent variable, while the NPL ones are capped at 7%.

Table 5.11: General Method of Moments Model: Z-score (Balkans & CEE)

Variables	Auto. Sel. of IV matrix	Reduced Form of IV	IV Matrix where # Moments Grows with KT	Arellano & Bond (1991) Instruments
HH's FX Loans	-4.47E-07	-1.96E-06	-1.24E-06	-1.79E-06
	(1.93E-06)	(2.34E-06)	(1.92E-06)	(2.33E-06)
Non-Fin. Corp. FX Loans	5.67E-07	4.93E-07	5.18E-07	3.18E-07
	(2.37E-06)	(2.52E-06)	(2.46E-06)	(2.51E-06)
Gov. FX Loans	1.02E-05	1.53E-05	2.93E-05	1.42E-05
	(1.23E-05)	(1.62E-05)	(1.15E-05) *	(1.61E-05)
NPL	-1.93E-03	-1.41E-03	-2.62E-03	-1.41E-03

	(1.49E-04)	(1.10E-04)	(2.73E-04)	(1.11E-04)
	***	***	***	***
Inflation	1.40E-03	1.05E-03	1.28E-03	1.07E-03
	(1.09E-04)	(8.24E-05)	(1.33E-04)	(8.40E-05)
	***	***	***	***
Lending Rate	-5.45E-04	-5.53E-04	-2.65E-04	-5.54E-04
	(4.23E-05)	(4.34E-05)	(2.76E-05)	(4.35E-05)
	***	***	***	***
ROA	2.03E-03	2.06E-03	1.82E-03	2.06E-03
	(1.58E-04)	(1.62E-04)	(1.90E-04)	(1.62E-04)
	***	***	***	***
ROE	4.04E-02	4.14E-02	3.16E-02	4.14E-02
	(3.13E-03)	(3.25E-03)	(3.30E-03)	(3.25E-03)
	***	***	***	***
Cap. to RWA	-1.18E-04	-8.80E-05	-4.35E-04	8.79E-05
	(9.19E-06)	(6.91E-06)	(4.54E-05)	(1.82E-05)
	***	***	***	***
Lagged Dep.	2.67E-04	-2.35E-04	-3.69E-04	-2.32E-04
	(2.67E-05)	(1.84E-05)	(3.86E-05)	(1.82E-05)
	***	***	***	***
R-Squared	0.688	0.689	0.680	0.689
Adjusted R-Squared	-n/a-	-n/a-	-n/a-	-n/a-

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

This table summarizes the general method of moments models with Z-score as dependent variables. In addition, the normal values in the table stand for the beta coefficients of the variable, while the values in parenthesis represent the standard errors.

Source: Author's Computation R-studio!

6 Conclusion

This thesis main aim is to prove that the foreign currency lending is one of the main relevant factors impacting the financial stability. The sample studied in this thesis is composed of Balkans and CEE countries. Such sample is chosen based on the motivation that the presence of foreign currency lending is supported in data and literature for its composing countries. In addition, it aimed to develop comparative analyzes among Balkans and CEE by studying them separately and together as well.

Such investigation has been carried by taking into consideration foreign currency lending across 3 main channels. More concretely, it has been considered under household, non-financial corporation and government channels, based on the belief that only under these channels foreign currency lending represents a threat to financial stability. In addition, the development of this investigation by breaking down the impact according to the formerly described channels constitutes one out of many points where this study contributes to the literature. Moreover, the financial stability has been measured by making use of z-score and NPL ratio. Both of these measures are widely discussed in the literature and their usage finds support in many studies. The primary aim was to use z-score for the banking sector as a primary measure and then perform robustness check by using NPL ratio. In such way, this thesis tried to provide consistency of results and reliability in the drawn conclusions.

In addition, there have been used additional explanatory variables whose main aim was to increase the explanatory power of the model and to avoid remedies associated with omission of relevant variables. The additional variables are inflation rate, lending rate, ROA, ROE, and capital to risk-weighted assets. All of the formerly mentioned variables are strongly supported by economic theory and literature findings as relevant factors in explaining financial instability.

Furthermore, the dataset formed upon the combination of the formerly described sample and variables has been analyzed under several econometric tests and models for panel data. More concretely, this thesis made use of pooled OLS, fixed effects, instrumental variables fixed effects and general method of moments based on Arellano and Bond instrumental variable matrix.

For the sample of Balkans the empirical analyses based on pooled OLS, fixed effects and instrumental variables methodologies, revealed the relevance of household channel as the main transmission route of financial instability. In addition, the output could not reveal any negative impact of non-financial corporation channel. Regarding the government channel, the impact was negative as well, thus confirming the latter one as a source of instability. Such dynamics were reverted under the general method of moments, where the household channel lost its negative impact, while the non-financial corporation and government channels turned negative. All the formerly described results were extracted under absolute preservation of within sample heterogeneity and their reliability has been subject to several testing.

Regarding the CEE sample alone the results turned out to be somehow unclear due to the fact that there was a presence of stationarity in the data, thus forcing us to correct it by taking the first difference. Such action indicated the results as it removed out any possible heterogeneity in the data by revealing only a general indication for the relationship. In this case, pooled OLS revealed a negative impact of the household channel towards financial stability, but such impact was reversed under fixed effects model. In addition, under the latter model, only the non-financial corporation channel was exerting a negative impact on financial stability. Instrumental variables regressions as well provide mixed dynamics, but in none of these models, the coefficients could not be found significant. The only model whose performance seemed to be differentiated is the general method of moments. Under this method, the analyses have been conducted by making use of variables in levels and not differencing them, thus preserving heterogeneity. Such step is undertaken based on the literature suggestions of GMM robustness towards stationarity related issues. The results indicate a negative impact of household and non-financial corporation channels on financial stability and this relationship was found to be significant at 5% significance level. Regarding the government channel, the impact was found to be positive and significant as well, which is explained with the reliability of governmental institutions and their small weights in the portfolio of foreign currency loans.

When joined both of the samples together the dynamics were to some extent consistent across models and ruling behaviors have been determined. Under this analyses, the impact of the household channel has been found to be positive, thus consistent with some of the findings in CEE alone and contradictory to the Balkans findings. In addition, the non-financial corporation channel is found to exert a negative

impact over financial stability, thus being in the same line with CEE findings again and matching the Balkans GMM findings as well. Such impact seem to be more prevailing under the CEE sample as the portion of loans related to this channel is quite substantial. The variable of government channel as well seems to exert a negative impact over financial stability. Such impact is in the same line with the Balkans findings and in contrast to CEE findings, thus revealing a dominance of this effect in the former case.

All in all, the former findings confirm the relevance of foreign currency lending in explaining a portion of financial instability. In addition, their impact is found to be country specific and decrypted across 3 main channels. The relations and dynamics of each channel to financial instability needs to be assessed based on country characteristics as not all 3 channels contribute in the same direction towards financial instability. This thesis was able to prove the foreign currency lending relevance, significance, main impact, and remarkable heterogeneity characterizing the Balkans and CEE sample.

For further research on the matter, the implications need to be strived in two main focuses. The first one is related to the model, where estimation based on panel co-integration and vector autoregressive analyses (VAR) could provide more robust results in terms of a short-run relationship. Secondly, another set of explanatory variables could reveal clearer dynamics and provide a more complete panorama of results. Lastly, additional consideration on demand or supply driving factors and their inclusion to the model estimation could help policymakers identify and act upon preservation of financial stability.

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Appendix A: Supplementary Methodology

Pooled OLS

Below can be found the derivation of the pooled OLS estimator:

$$y_{it} = \beta x_{it}^{*} + u_i + e_{it}, i = 1, \dots, N, t = 1, \dots, T.$$

The pooled OLS estimator is derived as follows,

$$\begin{aligned}
\beta_{POLS} &= \left[\frac{1}{NT}\sum_{t=1}^{T}\sum_{i=1}^{N}(x_{it}^{*}x_{it}^{*\prime})\right]^{-1}\left[\frac{1}{NT}\sum_{t=1}^{T}\sum_{i=1}^{N}(x_{it}^{*}y_{it})\right] \\
&= \left[\frac{1}{NT}\sum_{t=1}^{T}\sum_{i=1}^{N}(x_{it}+e_{it})(x_{it}+e_{it}')\right]^{-1}\left[\frac{1}{NT}\sum_{t=1}^{T}\sum_{i=1}^{N}(x_{it}\right. \\
&\left. + e_{it})(\beta(x_{it}+e_{it})+u_i+\varepsilon_t)\right] \\
&= \beta + \left[\frac{1}{NT}\sum_{t=1}^{T}\sum_{i=1}^{N}(x_{it}+e_{it})(x_{it}+e_{it}')\right]^{-1}\left[\frac{1}{NT}\sum_{t=1}^{T}\sum_{i=1}^{N}(x_{it}+e_{it})(u_i)\right] \\
&+ \left[\frac{1}{NT}\sum_{t=1}^{T}\sum_{i=1}^{N}(x_{it}+e_{it})(x_{it}+e_{it}')\right]^{-1}\left[\frac{1}{NT}\sum_{t=1}^{T}\sum_{i=1}^{N}(x_{it}+e_{it})(\varepsilon_{it})\right].
\end{aligned}$$

Where from the following expressions we get the covariance of among coefficients,

$$\left[\frac{1}{NT}\sum_{t=1}^{T}\sum_{i=1}^{N}(x_{it}+e_{it})(u_i)\right] \rightarrow \mathrm{cov}(x_{it},u_i) + cov(e_{it},u_i),$$

and

$$\left[\frac{1}{NT}\sum_{t=1}^{T}\sum_{i=1}^{N}(x_{it}+e_{it})(\varepsilon_{it}) \rightarrow \mathrm{cov}(x_{it},\varepsilon_{it}) + cov(e_{it},\varepsilon_{it})\right].$$

By assuming that the former covariance are equal to zero, the pooled estimator will be consistent:

$$E(\beta_{POLS}) = \beta, \text{if}$$
$$plim\ \ \mathrm{cov}(x_{it},u_i) = 0$$
$$plim\ \ cov(e_{it},u_i) = 0$$
$$plim\ \ \mathrm{cov}(x_{it},\varepsilon_{it}) = 0$$
$$plim\ \ cov(e_{it},\varepsilon_{it}) = 0$$

Fixed Effects (FE)

In case plim $\mathrm{cov}(\mathrm{x_{it}},\mathrm{u_i}) \neq 0$ then we should use Fixed Effects as its estimator would be consistent.

$$\beta_{FE} = \left[\frac{1}{NT}\sum_{t=1}^{T}\sum_{i=1}^{N}(x_{it}-\overline{x_i})(x_{it}-\overline{x_i})'\right]^{-1}\left[\frac{1}{NT}\sum_{t=1}^{T}\sum_{i=1}^{N}(x_{it}-\overline{x_i})\,(y_{it}-\overline{y_i})\right]$$
$$= \left[\frac{1}{NT}\sum_{t=1}^{T}\sum_{i=1}^{N}(x_{it}-\overline{x_i})(x_{it}-\overline{x_i})'\right]^{-1}\left[\frac{1}{NT}\sum_{t=1}^{T}\sum_{i=1}^{N}(x_{it}-\overline{x_i})\,[(x_{it}-\overline{x_i})\beta + (e_{it}-\bar{e}_i)]\right]$$
$$= \beta + \left[\frac{1}{NT}\sum_{t=1}^{T}\sum_{i=1}^{N}(x_{it}-\overline{x_i})(x_{it}-\overline{x_i})'\right]^{-1}\left[\frac{1}{NT}\sum_{t=1}^{T}\sum_{i=1}^{N}(x_{it}-\overline{x_i})\,(e_{it}-\bar{e}_i)\right]$$

β_{FE} is consistent if the $plim\ \ cov[(x_{it}-\overline{x_i})(e_{it}-\bar{e}_i)] = 0$

FE Beta equal to Beta Within

By making use of $\mathrm{M_D}$ we are leaded to the regression with a transformation of the data, $\mathrm{X_*} = \mathrm{M_D X}$ and $\mathrm{y_*} = \mathrm{M_D y}$. The $\mathrm{M_D}$matrix is as follows,

$$M_D = \begin{bmatrix} M^0 & 0 & 0 & \cdots & 0 \\ 0 & M^0 & 0 & \cdots & 0 \\ & & \cdots & & \\ 0 & 0 & 0 & \ldots & M^0 \end{bmatrix}.$$

As a result this produces the value of matrix in diagonals to be $\mathrm{M}^0 = \mathrm{I}_\mathrm{T} - \frac{1}{\mathrm{T}}\mathrm{ii}'$ and other points in M_D have a value equal to zero. From such derivation we end up with the within regression,

$$y_{it} - \bar{y}_{i.} = \alpha + (x'_{it} - \bar{x}_{i.})\beta + \varepsilon_{it} - \bar{\varepsilon}_{i.}.$$

GMM Matrix of Orthogonal Condition lines proof

$$1 + TK_1 + 2 + TK_1 + \cdots + TK_1 + (T-1) = T(T-1)K_1 + 1 + 2 + \cdots + (T-1)$$
$$= T(T-1)K_1 + \frac{T(T-1)}{2} = T(T-1)(K_1 + \frac{1}{2})$$

GMM Matrix of Orthogonal Condition lines proof with pre-determined variables

$$1 + K_1 + 2 + 2K_1 + \cdots + (T-1)K_1 + (T-1) = (1 + K_1)[1 + 2 + \cdots + (T-1)]$$
$$= (1 + K_1)\frac{T(T-1)}{2}$$

Unit root tests

Im, Pesaran, and Shin Test for Unit Root: Im, Pesaran, and Shin (2003)

These tests initiate by determining an Augmented Dickey-Fuller regression at every cross section. Its null hypothesis states that there is a unit root, meaning that the data are non-stationary. In order to provide a test value, the average of t-statistics produced by every ADF regression is taken into account and then it is adjusted to arrive at the desired outcome. The alternative hypothesis, on the other hand, states that the data are stationary. Such hypothesis can only be accepted if the test statistic is larger than the critical value at 5% significance level.

Fisher-ADF and Fisher-PP: Maddala and Wu (1999) and Choi (2001)

These tests are making use of Fisher's (1932) results in order to derive tests combining p-values from specific unit root tests. More concretely, these tests determine the unit root tests p-values for every cross section and test the null stating the presence of non-stationary process in the data. For the test using ADF statistics, it is necessary to specify

the number of lags used in every cross-section ADF regression. Regarding PP test, it is necessary to determine a method to estimate the function. In this case, the test has been estimated by making use of the kernel-based sum of covariances.

Pooled vs. Fixed Effects: F-Test

The F-test logic is based on testing whether the all fixed effects are jointly significantly different from zero or not. More concretely, the pooled model would be preferable to fixed effects in case the joint significance of fixed effects would be zero. Thus the null hypothesis speaks in favor of pooled model, while the alternative supports the fixed effects model. As a result, the F-test produces a test value, which if it is greater than the critical value would provide enough evidence to reject the null of no fixed effects.

Autocorrelation and Heteroskedasticity: Breusch-Godfrey and Breusch Pagan Tests

Autocorrelation issue is related to the case when the residuals are correlated with one another, thus violating one of the classical assumptions. As a result, the standard errors are biased and unreliable. Such issue is then transmitted into hypothesis testing, thus making them invalid. Breusch-Godfrey test checks for the presence of this issue by stating in the null that there is no autocorrelation in the data.

Heteroskedasticity, on the other hand, is similarly reflected in the residuals like autocorrelation by making the standard errors unreliable and hypothesis testing invalid. Again similarly to the former remedy, it is a violation of the classical assumption of homoscedasticity or in other words of the assumption that the variance is constant in residuals. Such testing is performed by Breusch- Pagan test, which states under the null hypothesis no presence of such remedy, thus homoscedastic errors, while in the alternative presumes heteroskedasticity.

Cross-Sectional Dependence: Pesaran CD Test

Cross-sectional dependence check is based on the belief that individuals may respond to common shocks and under the presence of such issue there is a loss in efficiency of estimators and invalid statistical inference. This remedy is tested by making use of Pesaran CD test and its null hypothesis states no presence of cross-sectional dependencies.

Appendix B: Figures and Tables not included in the main text

Balkans: Z score and the core variables

Figure B.1: 3D Plot: Total Foreign Currency Loans & Z-score (Balkans)

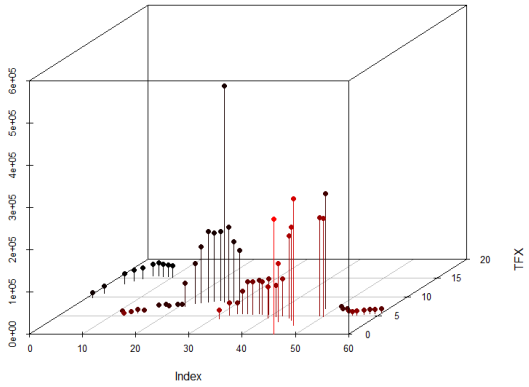


Figure B.2: 3D Plot: Households Foreign Currency Loans & Z-score (Balkans)

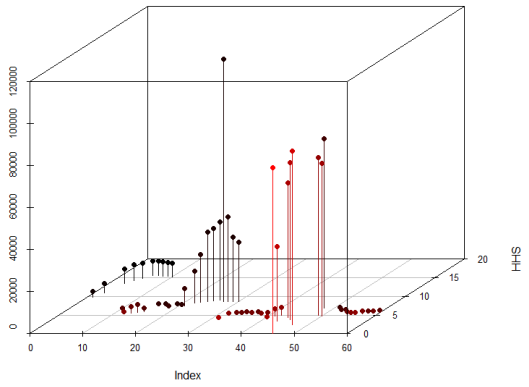


Figure B.3: 3D Plot: Non-Financial Corporations Foreign Currency Loans & Z-score (Balkans)

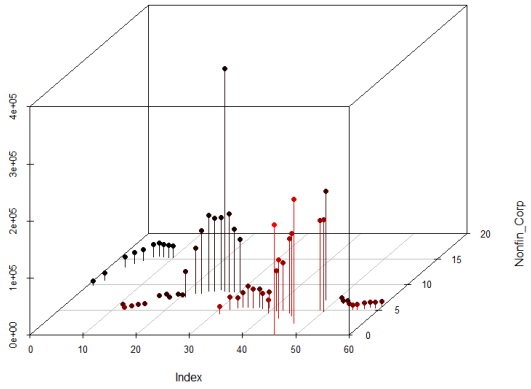


Figure B.4: 3D Plot: Government Foreign Currency Loans & Z-score (Balkans)

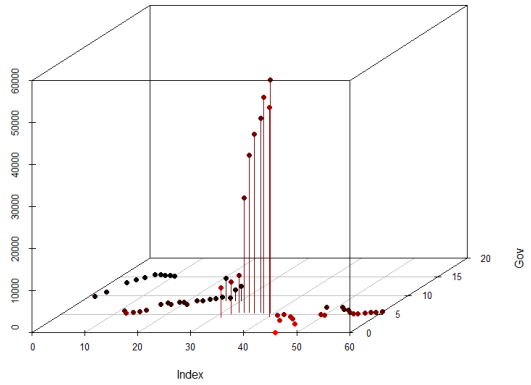


Figure B.5: 3D Plot: Total Foreign Currency Loans & NPL (Balkans)

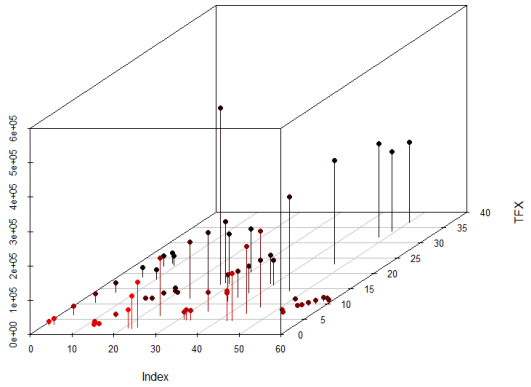


Figure B.6: 3D Plot: Households Foreign Currency Loans & NPL (Balkans)

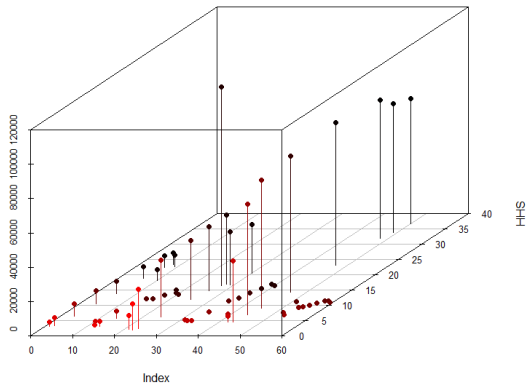


Figure B.7: 3D Plot: Non-Financial Corporations Foreign Currency Loans & NPL (Balkans)

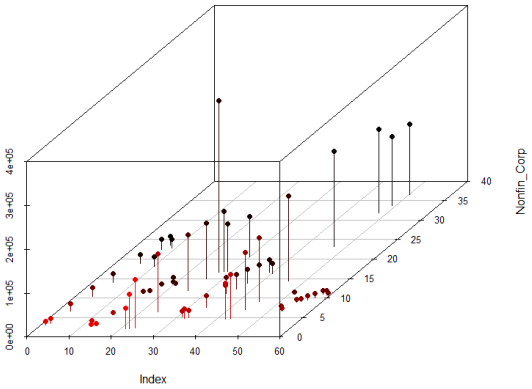
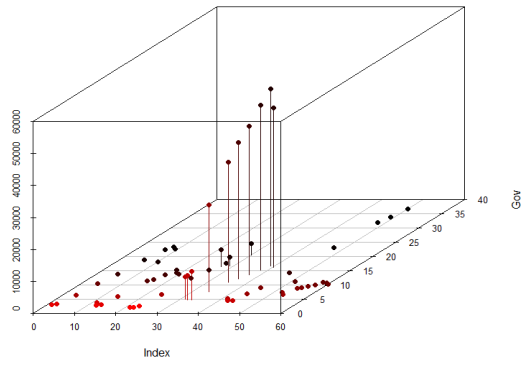


Figure B.8: 3D Plot: Government Foreign Currency Loans & NPL (Balkans)



In the former figures from B.1 to B.8 are plotted the foreign currency loans in total and broken down in channels against the financial stability indicators. The vertical axis in each of the cases indicate the foreign currency loans amounts in millions of Euro, indexed by the author by using the historical exchange rate for each of the respective countries, while aiming to create a comparable and consistent dataset. The horizontal axis, named index, represents the total number of observations for the sample. Lastly, the right side axis represents the respective financial stability measures values.
Source: Author's Computation R-studio!

Table B.1: Pooled OLS: Z-Score Model (Balkans)

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
HH's FX Loans	-1.64E-04	-1.57E-04	-1.57E-04	-1.36E-04	-1.23E-04	-1.10E-04
	(5.08E-08)	(4.98E-05)	(3.95E-05)	(4.04E-05)	(4.05E-05)	(4.18E-05)
	**	**	***	**	**	*
Non-Fin. Corp. FX Loans	3.77E-05	3.32E-05	3.21E-05	2.80E-05	2.45E-05	2.24E-05
	(1.77E-05)	(1.75E-05)	(1.39E-05)	(1.37E-05)	(1.37E-05)	(1.37E-05)
	*	.	*	*	.	
Gov. FX Loans	-1.08E-04	-1.02E-04	-9.70E-05	-9.22E-05	-8.78E-05	-1.01E-04
	(2.98E-05)	(2.93E-05)	(2.33E-05)	(2.29E-05)	(2.27E-05)	(2.56E-05)
	***	***	***	***	***	***
NPL	2.50E-01	3.21E-01	3.43E-01	3.42E-01	3.53E-01	3.30E-01
	(6.22E-02)	(7.19E-02)	(5.71E-02)	(5.59E-02)	(5.53E-02)	(5.86E-02)
		***	***	***	***	***
Inflation		3.33E-01	1.19E-01	7.67E-02	1.06E-01	1.25E-01
		(1.81E-01)	(1.48E-01)	(1.47E-01)	(1.45E-01)	(1.46E-01)
		.				
Lending Rate			9.91E-01	9.57E-01	9.21E-01	8.97E-01
			(1.73E-01)	(1.70E-01)	(1.68E-01)	(1.69E-01)
			***	***	***	***
ROA				3.88E-01	1.10E-01	1.67E-01
				(2.12E-01)	(2.65E-01)	(2.69E-01)
				.	.	
ROE					4.77E-02	3.61E-02
					(2.82E-02)	(2.98E-02)
					.	
Cap. to RWA						1.81E-01
						(1.57E-02)
						*
Constant	5.65	4.08	-4.74	-4.65	-4.68	-7.18
	(0.0.81)	(1.16)	(1.8)	(1.76)	(1.73)	(2.77)
	***	***	*	*	**	*
R-Squared	0.323	0.363	0.606	0.630	0.650	0.659
Adjusted R-Squared	0.274	0.304	0.562	0.580	0.595	0.597

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

This table summarizes all the pooled OLS regressions having z-score as a dependent variable. In addition, the normal values in the table stand for the beta coefficients of the variable, while the values in parenthesis represent the standard errors. Clustering has been included in the model.

Source: Author's Computation R-studio!

Table B.2: Pooled OLS: NPL Model (Balkans)

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
HH's FX Loans	4.37E-04	3.09E-04	3.29E-04	3.07E-04	2.78E-04	2.89E-04
	(8.74E-05)	(7.70E-05)	(7.03E-05)	(7.27E-05)	(7.32E-05)	(7.36E-05)
	***	***	***	***	***	***
Non-Fin. Corp. FX Loans	4.37E-04	-6.25E-05	-6.58E-05	-6.18E-05	-5.43E-05	-5.57E-05
	(3.21E-05)	(2.79E-05)	(2.54E-05)	(2.56E-05)	(2.55E-05)	(2.54E-05)
	**	*	*	*	*	*
Gov. FX Loans	-1.04E-04	1.40E-04	1.57E-04	1.54E-04	1.47E-04	1.12E-04
	(5.70E-05)	(4.89E-05)	(4.48E-05)	(4.47E-05)	(4.41E-05)	(5.31E-05)
	***	**	***	**	**	*
Z-score	9.08E-01	8.39E-01	1.17	1.22	1.25	1.17
	(2.25E-01)	(1.88E-01)	(1.96E-01)	(1.99E-01)	(1.96E-01)	(2.08E-01)
	***	***	***	***	***	***
Inflation		-1.25	-9.08E-01	-8.45E-01	-8.62E-01	-7.97E-01
		(2.48E-01)	(2.47E-01)	(2.53E-01)	(2.48E-01)	(2.53E-01)
		***	***	**	**	**
Lending Rate			-1.29	-1.28	-1.24	-1.21
			(3.67E-01)	(3.67E-01)	(3.60E-01)	(3.60E-01)
			***	***	**	**
ROA				-4.56E-01	6.91E-02	1.80E-01
				(4.08E-01)	(5.01E-01)	(5.08E-01)
ROE					-9.28E-02	-1.10E-01
					(5.31E-02)	(5.50E-02)
					.	.
Cap. to RWA						3.43E-01
						(1.38E-01)
						***
Constant	2.56	6.41	14.6	14.5	14.2	8.93
	(2.09)	(1.90)	(2.92)	(2.91)	(2.86)	(5.42)
		**	***	***	***	
R-Squared	0.482	0.648	0.714	0.721	0.737	0.743
Adjusted R-Squared	0.444	0.615	0.682	0.683	0.695	0.697

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

This table summarizes all the pooled OLS regressions having NPL as a dependent variable. In addition, the normal values in the table stand for the beta coefficients of the variable, while the values in parenthesis represent the standard errors. Clustering has been included in the model.

Source: Author's Computation R-studio!

Table B.3: Fixed Effects: Z-Score Model (Balkans)

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
HH's FX Loans	-6.10E-05	-6.19E-05	-6.21E-05	-4.62E-05	-4.49E-05	-4.17E-05
	(2.05E-05)	(2.04E-05)	(2.13E-05)	(1.79E-05)	(1.73E-05)	(1.72E-05)
	**	**	**	*	*	*
Non-Fin. Corp.	1.43E-05	1.44E-05	1.45E-05	1.13E-05	1.22E-05	1.01E-05
FX Loans	(7.84E-06)	(7.80E-06)	(7.92E-06)	(6.59E-06)	(6.38E-06)	(6.44E-06)
	.	.	.	.	.	
Gov. FX Loans	-2.95E-05	-2.81E-05	-2.81E-05	-2.10E-05	-2.07E-05	-2.53E-06
	(1.92E-05)	(1.87E-05)	(1.90E-05)	(1.58E-05)	(1.53E-05)	(1.92E-05)
NPL	1.29E-01	1.47E-01	1.47E-01	1.50E-01	1.58E-01	1.73E-01
	(2.24E-02)	(2.64E-02)	(2.97E-02)	(2.46E-02)	(2.41E-02)	(2.56E-02)
	***	***	***	***	***	***
Inflation		8.03E-02	8.01E-02	3.66E-02	5.60E-02	3.62E-02
		(6.46E-02)	(6.59E-02)	(5.54E-02)	(5.43E-02)	(5.50E-02)
Lending Rate			3.31E-03	9.90E-04	3.49E-04	2.41E-02
			(1.28E-01)	(1.06E-01)	(1.02E-01)	(1.02E-01)
ROA				3.80E-01	2.49E-01	2.06E-01
				(7.96E-02)	(9.92E-02)	(1.01E-01)
				***	*	*
ROE					2.26E-02	2.92E-02
					(1.08E-02)	(1.15E-02)
					*	*
Cap. to RWA						-1.41E-01
						(9.28E-02)
R-Squared	0.407	0.425	0.425	0.613	0.647	0.664
Adjusted R-Squared	0.300	0.308	0.293	0.515	0.547	0.560

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

This table summarizes the fixed effects models with z-score as dependent variables. In addition, the normal values in the table stand for the beta coefficients of the variable, while the values in parenthesis represent the standard errors. Clustering has been included in the model.

Source: Author's Computation R-studio!

Table B.4: Fixed Effects: NPL Model (Balkans)

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
HH's FX Loans	3.96E-04	3.23E-04	3.35E-04	2.96E-04	2.79E-04	2.24E-04
	(9.31E-05)	(8.20E-05)	(7.73E-05)	(7.30E-05)	(7.04E-05)	(6.72E-05)
	***	***	***	***	***	**
Non-Fin. Corp. FX Loans	-8.47E-05	-6.82E-05	-6.71E-05	-6.14E-05	-6.42E-05	-4.20E-05
	(3.77E-05)	(3.27E-05)	(3.08E-05)	(2.86E-05)	(2.75E-05)	(2.63E-05)
	*	*	*	*	*	
Gov. FX Loans	2.54E-04	1.76E-04	1.30E-04	1.16E-04	1.11E-04	-378E-05
	(8.70E-05)	(7.70E-05)	(7.46E-05)	(6.94E-05)	(6.66.E-05)	(7.86E-05)
	**	*	.		.	
Z-score	3.09	2.63	2.29	2.93	3.05	2.90
	(5.34E-01)	(4.72E-01)	(4.62E-01)	(4.81E-01)	(4.64E-01)	(4.29E-01)
		***	***	***	***	***
Inflation		-1.01	-7.91E-01	-6.15E-01	-6.59E-01	-4.17E-01
		(2.36E-01)	(2.38E-01)	(2.29E-01)	(2.20E-01)	(2.17E-01)
		***	***	**	**	.
Lending Rate			-1.26	-1.06	-9.52E-01	-9.71E-01
			(4.71E-01)	(4.42E-01)	(4.27E-01)	(3.93E-01)
				*	*	*
ROA				-1.16	-5.83E-01	-2.47E-01
				(3.93E-01)	(4.56E-01)	(4.34E-01)
				**		
ROE					-1.03E-01	-1.47E-01
					(4.70E-02)	(4.53E-02)
					*	**
Cap. to RWA						1.08
						(3.55E-01)
						**
R-Squared	0.591	0.703	0.741	0.782	0.803	0.837
Adjusted R-Squared	0.517	0.642	0.682	0.726	0.748	0.786

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

This table summarizes the fixed effects models with NPL as dependent variables. In addition, the normal values in the table stand for the beta coefficients of the variable, while the values in parenthesis represent the standard errors. Clustering has been included in the model.

Source: Author's Computation R-studio!

Table B.5: F-Test for Fixed Effects (Balkans)

Dependent Variable	Model #	F-test: Testing for Fixed effects
Z-score	1	p-value < 2.2e-16
	2	p-value < 2.2e-16
	3	p-value < 2.2e-16
	4	p-value < 2.2e-16
	5	p-value < 2.2e-16
	6	p-value < 2.2e-16
NPL	1	p-value = 0.001647
	2	p-value = 0.008069
	3	p-value = 0.03659
	4	p-value = 0.002175
	5	p-value = 0.0009699
	6	p-value = 4.344e-05

Source: Author's Computation R-studio!

Table B.6: Tests for Autocorrelation, Heteroskedasticity and Cross-Sectional Dependence (Balkans)

Dependent Variable	Type	Model #	Breusch-Godfrey Test for Serial Correlation	Breusch-Pagan Test for Heteroskedasticity	Pesaran Test for cross-sectional Independence
Z-score	Pooled	1	p-value = 8.16e-06	p-value = 0.08525	p-value=0.698
		2	p-value = 4.271e-05	p-value = 0.2553	p-value=0.04641
		3	p-value = 0.0004467	p-value = 0.2237	p-value=0.08377
		4	p-value = 0.0002733	p-value = 0.3197	p-value = 0.06168
		5	p-value = 0.0003531	p-value = 0.1904	p-value = 0.04461
		6	p-value = 0.000137	p-value = 0.1556	p-value = 0.1275
	Fixed	1	p-value = 0.008899	p-value = 0.08525	p-value=0.4932
		2	p-value = 0.01601	p-value = 0.2553	p-value=0.7368
		3	p-value = 0.01261	p-value = 0.2237	p-value=0.7306
		4	p-value = 0.2039	p-value = 0.3197	p-value=0.8804
		5	p-value = 0.07596	p-value = 0.1904	p-value=0.64
		6	p-value = 0.1013	p-value = 0.1556	p-value=0.8079
NPL	Pooled	1	p-value = 1.58e-05	p-value = 6.981e-06	p-value < 2.2e-16
		2	p-value = 0.00195	p-value = 0.0002681	p-value =4.058e-07
		3	p-value = 0.00465	p-value = 0.0003634	p-value = 0.03422
		4	p-value = 0.0003031	p-value = 0.0001708	p-value = 0.05364
		5	p-value = 0.0004332	p-value = 1.662e-05	p-value =0.05037
		6	p-value = 0.001472	p-value = 1.389e-05	p-value = 0.102
	Fixed	1	p-value = 0.001857	p-value = 7.581e-06	p-value = 1.018e-06
		2	p-value = 0.02812	p-value = 6.981e-06	p-value = 1.98e-06
		3	p-value = 0.07468	p-value = 0.0002681	p-value = 0.004634
		4	p-value = 0.06899	p-value = 0.0003634	p-value = 0.001753
		5	p-value = 0.03961	p-value = 0.0001708	p-value = 0.0005048
		6	p-value = 0.2622	p-value = 1.662e-05	p-value = 0.07394

Source: Author's Computation R-studio!

Table B.7: Robust Fixed Effects: Z-Score Model (Balkans)

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
HH's FX Loans	-6.10E-05	-6.19E-05	-6.21E-05	-4.62E-05	-4.49E-05	-4.17E-05
	(2.77E-05)	(2.91E-05)	(3.15E-05)	(2.28E-05)	(2.97E-05)	(3.069E-05)
	**	*	.	*		
Non-Fin. Corp.	1.43E-05	1.44E-05	1.45E-05	1.13E-05	1.22E-05	1.01E-05
FX Loans	(1.00E-05)	(1.03E-05)	(1.08E-06)	(7.33E-06)	(9.19E-06)	(9.42E-06)
Gov. FX Loans	-2.95E-05	-2.81E-05	-2.81E-05	-2.10E-05	-2.07E-05	-2.53E-06
	(1.41E-05)	(1.28E-05)	(1.27E-05)	(1.16E-05)	(1.32E-05)	(1.24E-05)
	*	*	*	.		
NPL	1.29E-01	1.47E-01	1.47E-01	1.50E-01	1.58E-01	1.73E-01
	(3.56E-02)	(4.38E-02)	(4.69E-02)	(3.66E-02)	(4.47E-02)	(5.08E-02)
	***	**	**	***	***	**
Inflation		8.03E-02	8.01E-02	3.66E-02	5.60E-02	3.62E-02
		(5.49E-02)	(5.53E-02)	(5.60E-02)	(5.89E-02)	(4.73E-02)
Lending Rate			3.31E-03	9.90E-04	3.49E-04	2.41E-02
			(1.14E-01)	(8.95E-02)	(1.02E-01)	(9.81E-02)
ROA				3.80E-01	2.49E-01	2.06E-01
				(1.03E-01)	(1.30E-01)	(1.65E-01)
				***	.	
ROE					2.26E-02	2.92E-02
					(8.02E-03)	(9.87E-03)
					**	**
Cap. to RWA						-1.41E-01
						(1.11E-01)
R-Squared	0.407	0.425	0.425	0.613	0.647	0.664
Adjusted R-Squared	0.300	0.308	0.293	0.515	0.547	0.560

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

This table summarizes the robust fixed effects models with z-score as dependent variables. In addition, the normal values in the table stand for the beta coefficients of the variable, while the values in parenthesis represent the standard errors. Clustering has been included in the model.

Source: Author's Computation R-studio!

Table B.8: Robust Fixed Effects: NPL Model (Balkans)

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
HH's FX Loans	3.96E-04	3.23E-04	3.35E-04	2.96E-04	2.79E-04	2.24E-04
	(1.60E-04)	(1.37E-04)	(1.30E-04)	(1.32E-04)	(1.39E-04)	(1.34E-04)
	*	*	*	*	*	
Non-Fin. Corp.	-8.47E-05	-6.82E-05	-6.71E-05	-6.14E-05	-6.42E-05	-4.20E-05
FX Loans	(6.84E-05)	(5.65E-05)	(5.57E-05)	(5.02E-05)	(4.48E-05)	(4.71E-05)
Gov. FX Loans	2.54E-04	1.76E-04	1.30E-04	1.16E-04	1.11E-04	-3.78E-05
	(3.47E-05)	(2.91E-05)	(4.18E-05)	(4.09E-05)	(4.04E-05)	(7.76E-05)
	***	***	**	**	**	
Z-score	3.09	2.63	2.29	2.93	3.05	2.90
	(4.95E-01)	(5.08E-01)	(5.04E-01)	(4.48E-01)	(4.99E-01)	(3.60E-01)
	***	***	***	***	***	***
Inflation		-1.01	-7.91E-01	-6.15E-01	-6.59E-01	-4.17E-01
		(2.27E-01)	(1.82E-01)	(1.70E-01)	(1.84E-01)	(1.38E-01)
		***	***	***	***	**
Lending Rate			-1.26	-1.06	-9.52E-01	-9.71E-01
			(3.33E-01)	(43.10E-01)	(2.96E-01)	(2.54E-01)
			***	**	**	***
ROA				-1.16	-5.83E-01	-2.47E-01
				(5.38E-01)	(4.68E-01)	(5.85E-01)
				**		
ROE					-1.03E-01	-1.47E-01
					(5.12E-02)	(5.85E-02)
					*	*
Cap. to RWA						1.08
						(3.69E-01)
						**
R-Squared	0.591	0.703	0.741	0.782	0.803	0.837
Adjusted R-Squared	0.517	0.642	0.682	0.726	0.748	0.786

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

This table summarizes the robust fixed effects models with NPL as dependent variables. In addition, the normal values in the table stand for the beta coefficients of the variable, while the values in parenthesis represent the standard errors. Clustering has been included in the model.

Source: Author's Computation R-studio!

Table B.9: Instrumental Variables Fixed Effects: Z-Score Model (Balkans)

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
HH's FX Loans	-9.15E-05	-9.16E-05	-9.09E-05	-6.55E-05	-6.59E-05	-6.23E-05
	(3.03E-05)	(3.05E-05)	(3.26E-05)	(2.54E-05)	(2.41E-05)	(2.52E-05)
	**	**	**	*	**	*
Non-Fin. Corp. FX Loans	2.54E-05	2.53E-05	2.51E-05	1.83E-05	2.00E-05	1.83E-05
	(1.08E-05)	(1.09E-05)	(1.13E-05)	(8.76E-06)	(8.32E-06)	(8.99E-06)
	*	*	*	*	*	*
Gov. FX Loans	-4.52E-05	-4.38E-05	-4.41E-05	-3.55E-05	-3.59E-05	-2.98E-06
	(2.18E-05)	(2.21E-05)	(2.25E-05)	(1.73E-05)	(1.64E-05)	(2.09E-05)
	*	.	.	*	*	
NPL	1.24E-01	1.33E-01	1.32E-01	1.31E-01	1.40E-01	1.44E-01
	(2.37E-02)	(2.80E-02)	(3.26E-02)	(2.49E-02)	(2.39E-02)	(2.53E-02)
	***	***	***	***	***	***
Inflation		4.38E-02	4.45E-02	5.29E-03	2.53E-02	1.94E-02
		(6.64E-02)	(6.79E-02)	(5.25E-02)	(5.03E-02)	(5.17E-02)
Lending Rate			-1.01E-01	-1.81E-02	-1.45E-02	-1.41E-02
			(1.38E-02)	(1.06E-01)	(1.00E-01)	(1.00E-01)
ROA				3.67E-01	2.27E-01	2.15E-01
				(7.30E-02)	(8.90E-02)	(9.26E-02)
				***	*	*
ROE					2.40E-02	2.60E-02
					(9.64E-03)	(1.04E-02)
					*	*
Cap. to RWA						-4.75E-02
						(1.01E-01)
						*
R-Squared	0.334	0.341	0.343	0.617	0.666	0.676
Adjusted R-Squared	0.198	0.188	0.170	0.505	0.558	0.560

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

This table summarizes the instrumental variables fixed effects models with z-score as dependent variables. In addition, the normal values in the table stand for the beta coefficients of the variable, while the values in parenthesis represent the standard errors. Clustering has been included in the model.

Source: Author's Computation R-studio!

Table B.10: Instrumental Variables Fixed Effects: NPL Model (Balkans)

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
HH's FX Loans	6.41E-04	5.22E-04	5.48E-04	4.88E-04	4.67E-04	3.56E-04
	(1.50E-04)	(1.36E-04)	(1.30E-04)	(1.21E-04)	(1.15E-04)	(1.18E-04)
	***	***	***	***	***	**
Non-Fin. Corp. FX Loans	-1.74E-04	-1.39E-04	-1.44E-04	-1.29E-04	-1.31E-04	-8.85E-05
	(5.62E-05)	(5.03E-05)	(4.79E-05)	(4.43E-05)	(4.21E-05)	(4.38E-05)
	**	**	**	**	**	.
Gov. FX Loans	3.06E-04	2.14E-04	1.43E-04	1.41E-04	1.44E-04	9.68E-06
	(1.13E-04)	(1.03E-04)	(1.01E-04)	(9.35E-05)	(8.87E-05)	(1.04E-05)
	**	*				
Z-score	3.34	2.81	2.31	3.27	3.56	3.38
	(6.91E-01)	(6.24E-01)	(6.25E-01)	(6.88E-01)	(6.65E-01)	(6.13E-01)
	***	***	***	***	***	***
Inflation		-9.09E-01	-6.50E-01	-4.74E-01	-5.09E-01	-3.35E-01
		(2.80E-01)	(2.85E-01)	(2.70E-01)	(2.57E-01)	(2.49E-01)
		***	*	.	.	
Lending Rate			-1.46	-1.17	-1.01	-9.09E-01
			(5.71E-01)	(5.37E-01)	(5.14E-01)	(4.72E-01)
			*	*	.	.
ROA				-1.19	-6.21E-01	-3.48E-01
				(4.72E-01)	(5.16E-01)	(4.90E-01)
				*		
ROE					-1.16E-01	-1.49E-01
					(5.25E-02)	(5.05E-02)
					*	**
Cap. to RWA						9.74E-01
						(4.78E-01)
						*
R-Squared	0.510	0.630	0.674	0.731	0.763	0.806
Adjusted R-Squared	0.410	0.544	0.589	0.652	0.687	0.736

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

This table summarizes the instrumental variables fixed effects models with NPL as dependent variables. In addition, the normal values in the table stand for the beta coefficients of the variable, while the values in parenthesis represent the standard errors. Clustering has been included in the model.

Source: Author's Computation R-studio!

Table B.11: General Method of Moments: NPL Model (Balkans)

Variables	Auto. Sel. of IV matrix	Reduced Form of IV	IV Matrix where # Moments Grows with KT	Arellano & Bond (1991) Instruments
HH's FX Loans	7.47E-05	4.34E-05	3.24E-04	4.19E-05
	(5.46E-05)	(5.90E-05)	(5.59E-05)	(9.83E-06)
			***	
Non-Fin. Corp. FX	-1.72E-05	-1.11E-05	-8.27E-05	-9.76E-06
Loans	(1.99E-05)	(2.10E-05)	(2.05E-05)	(2.09E-05)
			***	
Gov. FX Loans	2.45E-04	2.04E-04	2.67E-04	2.05E-04
	(6.67E-05)	(8.59E-05)	(4.80E-05)	(8.51E-05)
	**	*	***	*
Z-score	-3.55E-04	1.83E-04	-7.05E-05	2.12E-04
	(7.93E-04)	(8.65E-04)	(1.08E-03)	(8.62E-04)
Inflation	-5.04E-05	-1.15E-05	-4.08E-06	-2.05E-05
	(1.12E-04)	(5.43E-05)	(1.06E-04)	(8.34E-05)
Lending Rate	2.14E-05	-1.14E-05	6.90E-06	-2.04E-04
	(4.79E-05)	(5.41E-05)	(1.06E-04)	(8.32E-05)
ROA	-5.21E-04	2.25E-04	-1.10E-04	2.48E-03
	(1.16E-03)	(1.06E-03)	(1.69E-03)	(1.00E-03)
ROE	-1.05E-02	5.22E-02	-1.63E-03	6.05E-03
	(2.35E-02)	(2.46E-02)	(2.52E-02)	(2.45E-02)
Cap. to RWA	-1.78E-04	1.20E-04	-2.93E-05	1.40E-04
	(3.98E-04)	(5.67E-04)	(4.53E-04)	(3.40E-05)
Lagged Dep.	-1.02E-04	6.99E-04	-4.05E-05	9.83E-05
	(2.29E-04)	(3.30E-04)	(6.26E-04)	(3.99E-04)
R-Squared	0.001	0.009	0.000	0.010
Adjusted R-Squared	-n/a-	-n/a-	-n/a-	-n/a-

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

This table summarizes the general method of moments models with NPL as dependent variables. In addition, the normal values in the table stand for the beta coefficients of the variable, while the values in parenthesis represent the standard errors.

Source: Author's Computation R-studio!

CEE

Figure B.9: 3D Plot: Total Foreign Currency Loans & Z-score (CEE)

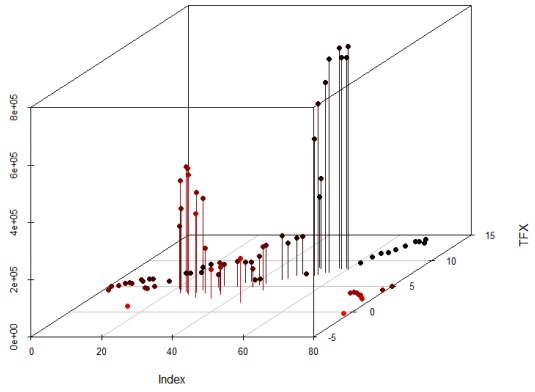


Figure B.10: 3D Plot: Households Foreign Currency Loans & Z-score (CEE)

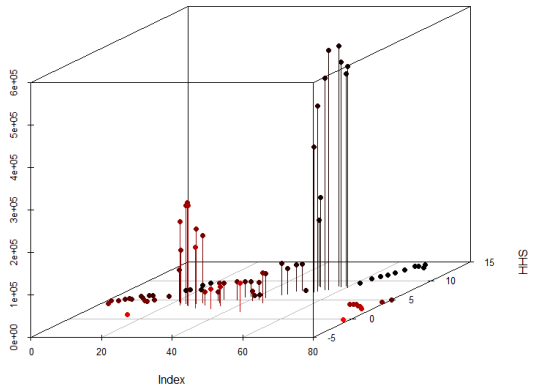


Figure B.11: 3D Plot: Non-Financial Corporation Foreign Currency Loans & Z-score (CEE)

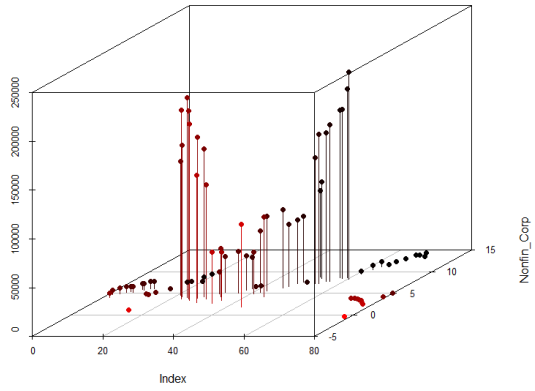


Figure B.12: 3D Plot: Government Foreign Currency Loans & Z-score (CEE)

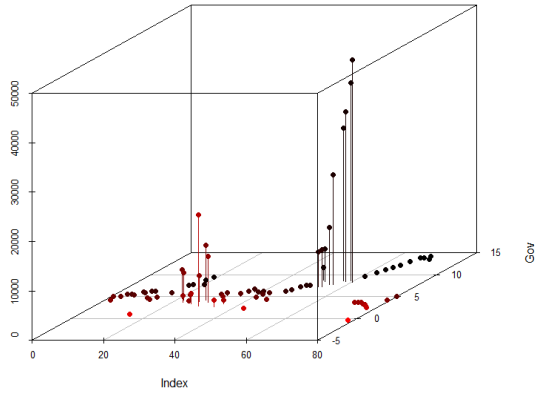


Figure B.13: 3D Plot: Total Foreign Currency Loans & NPL (CEE)

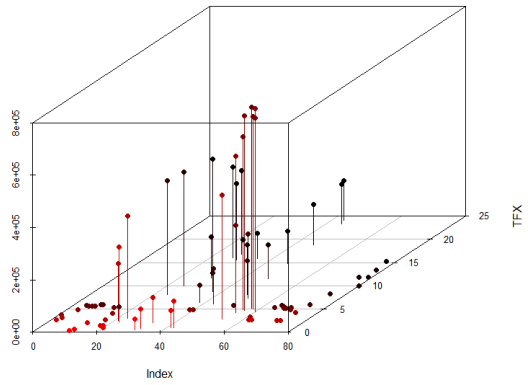


Figure B.14 : 3D Plot: Households Foreign Currency Loans & NPL (CEE)

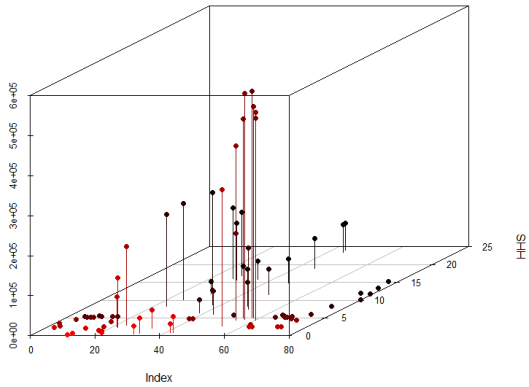


Figure B.15: 3D Plot: Non-Financial Corporations Foreign Currency Loans & NPL (CEE)

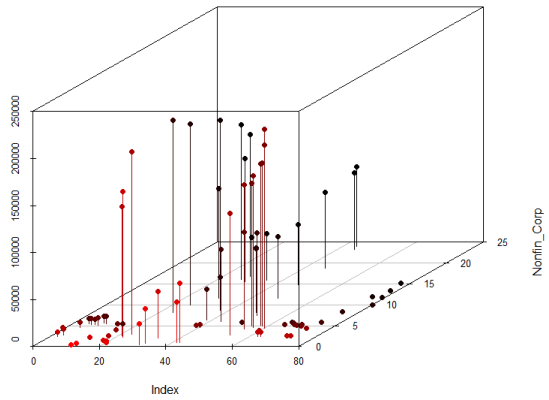
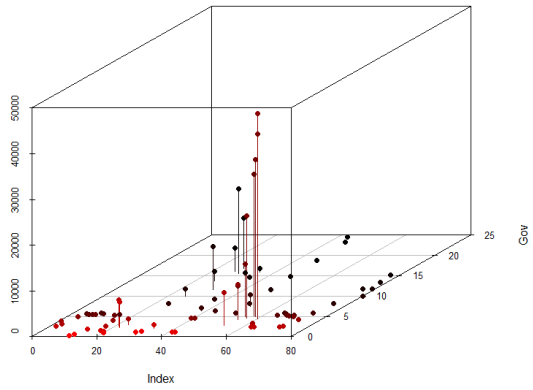


Figure B.16: 3D Plot: Government Foreign Currency Loans & NPL (CEE)



In the former figures from B.9 to B.16 are plotted the foreign currency loans in total and broken down in channels against the financial stability indicators. The vertical axis in each of the cases indicate the foreign currency loans amounts in millions of Euro, indexed by the author by using the historical exchange rate for each of the respective countries, while aiming to create a comparable and consistent dataset. The horizontal axis, named index, represents the total number of observations for the sample. Lastly, the right side axis represents the respective financial stability measures values.
Source: Author's Computation R-studio!

Table B.12: First Difference: Z-Score Model (CEE)

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
HH's FX Loans	-4.50E-06	-4.95E-06	-3.99E-06	-9.81E-07	-1.63E-06	-2.05E-06
	(6.47E-06)	(6.38E-06)	(6.34E-06)	(4.36E-06)	(3.16E-06)	(2.66E-06)
Non-Fin. Corp. FX	5.15E-06	2.10E-06	-4.39E-08	1.79E-07	1.07E-07	2.37E-06
Loans	(1.50E-05)	(1.49E-05)	(1.48E-05)	(1.01E-05)	(7.37E-05)	(6.23E-06)
Gov. FX Loans	3.80E-06	9.48E-06	6.37E-07	3.10E-05	2.81E-05	2.91E-05
	(5.72E-05)	(5.61E-05)	(5.62E-05)	(3.87E-05)	(2.80E-05)	(2.36E-05)
NPL	-1.54E-01	-1.18E-01	-1.108E-01	2.44E-02	2.39E-02	2.71E-02
	(4.49E-02)	(4.87E-02)	(4.86E-02)	(3.67E-02)	(3.66E-02)	(2.24E-02)
	**	*	*			
Inflation		8.96E-02	9.90E-02	-3.46E-04	1.17E-02	3.98E-02
		(5.14E-02)	(5.12E-02)	(3.69E-02)	(2.68E-02)	(2.32E-02)
		.	.			.
Lending Rate			-9.30E-02	7.23E-03	8.12E-03	-7.54E-04
			(5.96E-01)	(4.25E-02)	(3.07E-02)	(2.60E-02)
ROA				6.18E-01	2.19E-01	2.48E-01
				(7.13E-02)	(7.30E-02)	(6.18E-02)
				***	**	***
ROE					3.34E-02	3.19E-02
					(4.32E-03)	(3.65E-03)
					***	***
Cap. to RWA						1.23E-01
						(2.37E-02)
						***
R-Squared	0.181	0.227	0.257	0.662	0.845	0.878
Adjusted R-Squared	0.145	0.180	0.201	0.631	0.828	0.863

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

This table summarizes all the first difference regressions having z-score as a dependent variable. In addition, the normal values in the table stand for the beta coefficients of the variable, while the values in parenthesis represent the standard errors. Clustering has been included in the model.

Source: Author's Computation R-studio!

Table B.13: First Difference: NPL Model (CEE)

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
HH's FX Loans	-7.31E-06	-4.01E-06	-4.74E-06	-5.54E-06	-4.94E-06	-3.91E-06
	(1.61E-05)	(1.53E-05)	(1.55E-05)	(1.46E-05)	(1.47E-05)	(1.48E-05)
Non-Fin. Corp.	4.69E-05	5.25E-05	5.42E-05	4.75E-05	4.72E-05	4.42E-05
FX Loans	(3.71E-05)	(3.53E-05)	(3.55E-05)	(3.37E-05)	(3.39E-05)	(3.41E-05)
Gov. FX Loans	6.22E-05	3.32E-05	4.12E-05	-1.22E-05	-1.83E-05	-2.82E-05
	(1.42E-04)	(1.35E-04)	(1.36E-04)	(1.30E-04)	(1.31E-04)	(1.32E-04)
Z-score	-9.58E-01	-6.85E-01	-6.47E-01	2.72E-01	5.21E-01	8.36E-01
	(2.78E-01)	(2.81E-01)	(2.89E-01)	(4.15E-01)	(5.79E-01)	(6.90E-01)
	**	*	*			
Inflation		-3.44E-01	-3.54E-01	-2.39E-01	-2.44E-01	-2.75E-01
		(1.19E-01)	(1.20E-01)	(1.20E-01)	(1.21E-01)	(1.27E-01)
		**	**	.	*	*
Lending Rate			8.90E-02	-1.03E-03	-3.26E-03	3.65E-03
			(1.47E-01)	(1.42E-01)	(1.43E-01)	(1.44E-01)
ROA				-9.77E-01	-9.20E-01	-1.01
				(3.30E-01)	(3.45E-01)	(3.62E-01)
				**	**	**
ROE					-1.71E-02	-2.60E-02
					(2.80E-02)	(3.00E-02)
Cap. to RWA						-1.32E-01
						(1.56E-01)
R-Squared	0.191	0.268	0.272	0.352	0.355	0.362
Adjusted R-Squared	0.156	0.225	0.217	0.292	0.284	0.281

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

This table summarizes all the first difference regressions having NPL as a dependent variable. In addition, the normal values in the table stand for the beta coefficients of the variable, while the values in parenthesis represent the standard errors. Clustering has been included in the model.

Source: Author's Computation R-studio!

Table B.14: Instrumental Variables First Difference: Z-Score Model (CEE)

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
HH's FX Loans	-5.14E-06	-3.89E-06	-2.63E-06	5.04E-06	3.76E-06	1.36E-06
	(1.02E-05)	(9.94E-06)	(9.97E-06)	(6.75E-06)	(4.76E-06)	(3.99E-06)
Non-Fin. Corp. FX Loans	1.36E-05	5.40E-06	1.84E-06	-1.64E-05	-1.41E-05	-5.28E-06
	(2.88E-05)	(2.84E-05)	(2.85E-05)	(1.92E-05)	(1.35E-05)	(1.14E-05)
Gov. FX Loans	-1.02E-04	-7.24E-05	-1.04E-04	3.44E-05	2.03E-05	1.86E-06
	(1.15E-04)	(1.13E-04)	(1.15E-04)	(7.91E-05)	(5.57E-05)	(4.65E-05)
NPL	-1.56E-01	-1.19E-01	-1.068E-01	3.14E-02	2.95E-02	2.98E-02
	(4.96E-02)	(5.35E-02)	(5.41E-02)	(4.01E-02)	(2.82E-02)	(2.34E-02)
	**	*	.			
Inflation		9.07E-02	9.66E-02	-1.01E-03	1.05E-02	3.89E-02
		(5.78E-02)	(5.78E-02)	(4.06E-02)	(2.86E-02)	(2.45E-02)
Lending Rate			-1.09E-01	4.29E-03	4.03E-03	-4.98E-03
			(6.92E-01)	(4.85E-02)	(3.41E-02)	(2.84E-02)
ROA				6.33E-01	2.28E-01	2.46E-01
				(7.83E-02)	(7.67E-02)	(6.39E-02)
				***	**	***
ROE					3.37E-02	3.23E-02
					(4.45E-03)	(3.71E-03)
					***	***
Cap. to RWA						1.17E-01
						(2.46E-02)
						***
R-Squared	0.161	0.234	0.248	0.657	0.845	0.892
Adjusted R-Squared	0.119	0.182	0.183	0.621	0.828	0.876

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

This table summarizes all the instrumental variables first difference regressions having z-score as a dependent variable. In addition, the normal values in the table stand for the beta coefficients of the variable, while the values in parenthesis represent the standard errors. Clustering has been included in the model.

Source: Author's Computation R-studio!

Table B.15: Instrumental Variables First Difference: NPL Model (CEE)

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
HH's FX Loans	1.75E-05	1.59E-05	1.51E-05	8.79E-06	8.49E-06	1.17E-05
	(2.58E-05)	(2.44E-05)	(2.46E-05)	(2.38E-05)	(2.41E-05)	(2.44E-05)
Non-Fin. Corp.	-1.22E-05	6.96E-05	9.23E-06	2.38E-05	2.77E-05	1.87E-05
FX Loans	(7.20E-05)	(6.86E-05)	(6.90E-05)	(6.60E-05)	(6.77E-05)	(6.86E-05)
Gov. FX Loans	4.02E-05	-6.93E-05	-4.70E-05	-2.45E-04	-2.81E-04	-3.04E-04
	(2.69E-04)	(2.58E-04)	(2.63E-04)	(2.63E-04)	(2.70E-04)	(2.73E-04)
Z-score	-9.72E-01	-6.84E-01	-6.49E-01	3.62E-01	7.47E-01	1.23
	(3.01E-01)	(3.05E-01)	(3.14E-01)	(4.74E-01)	(6.98E-01)	(8.39E-01)
	**	*	*			
Inflation		-3.57E-01	-3.62E-01	-2.43E-01	-2.49E-01	-2.96E-01
		(1.33E-01)	(1.34E-01)	(1.36E-01)	(1.38E-01)	(1.46E-01)
		**	**	.	.	*
Lending Rate			8.65E-02	-2.82E-02	-3.56E-02	-3.11E-02
			(1.68E-01)	(1.68E-01)	(1.70E-01)	(1.72E-01)
ROA				-1.06	-1.01	-1.14
				(3.84E-01)	(3.94E-01)	(4.16E-01)
				**	*	**
ROE					-2.44E-02	-3.84E-02
					(3.22E-02)	(3.50E-02)
Cap. to RWA						-1.86E-01
						(1.77E-01)
R-Squared	0.171	0.253	0.260	0.323	0.319	0.326
Adjusted R-Squared	0.130	0.203	0.196	0.252	0.233	0.228

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

This table summarizes all the instrumental variables first difference regressions having NPL as a dependent variable. In addition, the normal values in the table stand for the beta coefficients of the variable, while the values in parenthesis represent the standard errors. Clustering has been included in the model.

Source: Author's Computation R-studio!

Table B.16: General Method of Moments: Z-Score Model (CEE)

Variables	Auto. Sel. of IV matrix	Reduced Form of IV	IV Matrix where # Moments Grows with KT	Arellano & Bond (1991) Instruments
HH's FX Loans	5.27E-07	2.56E-06	2.69E-06	-1.26E-06
	(2.02E-06)	(2.59E-06)	(1.93E-06)	(2.37E-06)
Non-Fin. Corp. FX Loans	-2.91E-06	-8.66E-06	-1.13E-05	-1.55E-06
	(6.18E-06)	(7.44E-06)	(5.41E-06) *	(6.74E-06)
Gov. FX Loans	2.17E-05	9.04E-05	3.34E-05	1.85E-05
	(1.44E-05)	(1.94E-05) **	(1.08E-05) **	(1.90E-05)
NPL	-2.88E-03	-2.69E-03	-3.42E-03	-2.38E-03
	(1.93E-04) ***	(2.37E-04) ***	(2.52E-04) ***	(1.68E-04) ***
Inflation	1.93E-03	2.02E-03	1.72E-03	1.89E-03
	(1.30E-04) ***	(1.78E-04) ***	(1.26E-04) ***	(1.33E-04) ***
Lending Rate	-1.01E-03	-7.55E-03	-7.60E-04	-8.22E-04
	(6.80E-05) ***	(6.68E-05) ***	(5.60E-05) ***	(2.03E-05) ***
ROA	2.42E-03	2.07E-03	2.46E-03	2.33E-03
	(1.62E-04) ***	(1.83E-04) ***	(1.81E-04) ***	(1.65E-04) ***
ROE	4.41E-02	3.81E-02	4.05E-02	4.40E-02
	(2.97E-03) ***	(3.36E-03) ***	(2.98E-03) ***	(3.11E-03) ***
Cap. to RWA	5.18E-04	-1.11E-03	-9.91E-04	-4.59E-04
	(3.49E-05) ***	(9.87E-05) ***	(7.30E-05) ***	(3.24E-05) ***
Lagged Dep.	-4.35E-04	-4.66E-04	-3.75E-04	-5.32E-04
	(2.92E-07) ***	(4.12E-05) ***	(2.76E-05) ***	(3.76E-05) ***
R-Squared	0.832	0.779	0.818	0.835
Adjusted R-Squared	-n/a-	-n/a-	-n/a-	-n/a-

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

This table summarizes the general method of moments models with z-score as dependent variables. In addition, the normal values in the table stand for the beta coefficients of the variable, while the values in parenthesis represent the standard errors.

Source: Author's Computation R-studio!

Table B.17: General Method of Moments: NPL Model (CEE)

Variables	Auto. Sel. of IV matrix	Reduced Form of IV	IV Matrix where # Moments Grows with KT	Arellano & Bond (1991) Instruments
HH's FX Loans	-2.13E-06	-1.11E-05	-2.12E-06	-4.49E-06
	(1.04E-05)	(1.18E-05)	(9.61E-06)	(1.21E-05)
Non-Fin. Corp. FX Loans	8.13E-05	8.49E-05	1.81E-05	6.15E-05
	(3.11E-05)	(3.09E-05)	(2.57E-05)	(3.36E-05)
	*	*		.
Gov. FX Loans	-9.89E-06	-2.83E-05	2.74E-05	4.78E-05
	(7.54E-05)	(9.43E-05)	(5.47E-05)	(9.52E-05)
Z-score	-2.87E-03	-2.63E-03	-3.95E-03	-2.12E-03
	(6.80E-04)	(7.55E-04)	(7.80E-04)	(7.03E-04)
	**	*	***	**
Inflation	-2.95E-03	-1.98E-03	-2.33E-03	-1.88E-03
	(7.00E-04)	(5.70E-04)	(4.61E-04)	(6.22E-04)
	**	*	***	**
Lending Rate	1.25E-03	1.17E-03	1.58E-03	1.01E-03
	(2.98E-04)	(3.36E-04)	(3.13E-04)	(3.36E-04)
	**	*	***	**
ROA	-3.50E-03	-2.96E-03	-4.88E-03	-2.50E-03
	(8.31E-04)	(8.51E-04)	(9.64E-04)	(8.26E-04)
	**	*	***	**
ROE	-6.50E-02	-5.57E-02	-7.85E-02	-4.80E-02
	(1.54E-02)	(1.60E-02)	(1.55E-02)	(1.58E-02)
	**	*	***	**
Cap. to RWA	1.03E-03	3.37E-05	3.38E-04	4.53E-04
	(2.45E-04)	(9.69E-06)	(6.68E-05)	(1.49E-04)
	**	*	***	**
Lagged Dep.	7.97E-04	-3.33E-04	2.63E-04	-4.09E-04
	(1.88E-04)	(9.58E-05)	(5.15E-05)	(1.35E-04)
	**	*	***	**
R-Squared	0.200	0.196	0.188	0.200
Adjusted R-Squared	-n/a-	-n/a-	-n/a-	-n/a-

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

This table summarizes the general method of moments models with NPL as dependent variables. In addition, the normal values in the table stand for the beta coefficients of the variable, while the values in parenthesis represent the standard errors.

Source: Author's Computation R-studio!

Balkans & CEE

Figure B.17: 3D Plot: Total Foreign Currency Loans & Z-Score (Balkans & CEE)

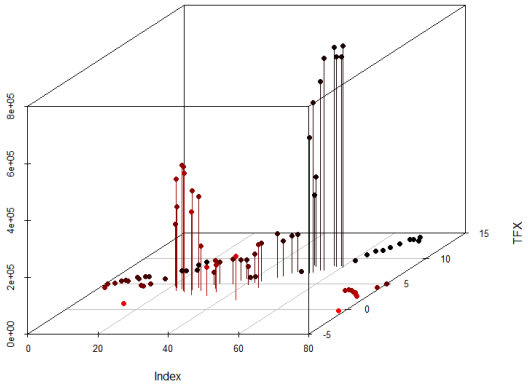


Figure B.18: 3D Plot: Households Foreign Currency Loans & Z-Score (Balkans & CEE)

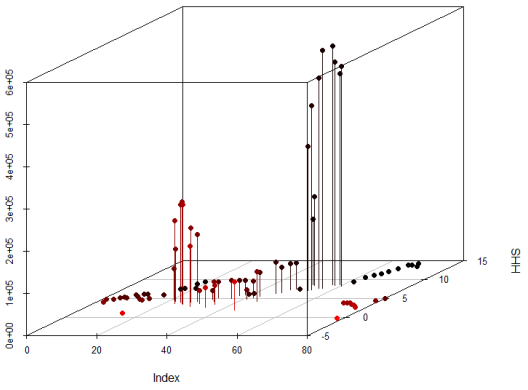


Figure B.19: Non-Financial Corporation Foreign Currency Loans & Z-Score (Balkans & CEE)

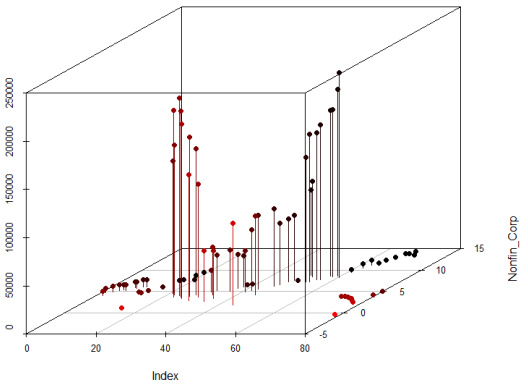


Figure B.20: Government Foreign Currency Loans & Z-Score (Balkans & CEE)

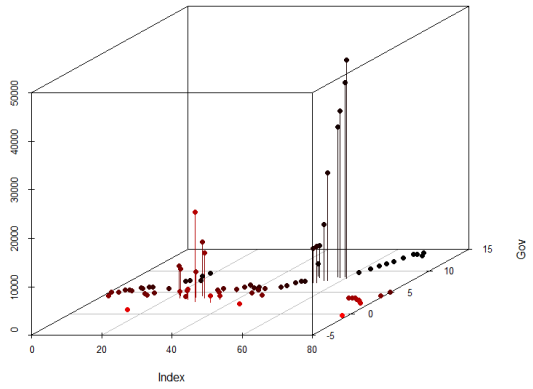


Figure B.21: Total Foreign Currency Loans & NPL (Balkans & CEE)

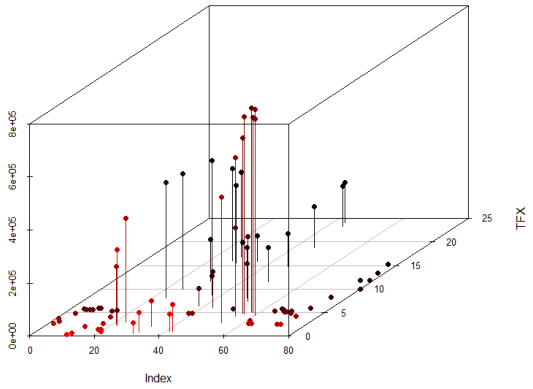


Figure B.22: Households Foreign Currency Loans & NPL (Balkans & CEE)

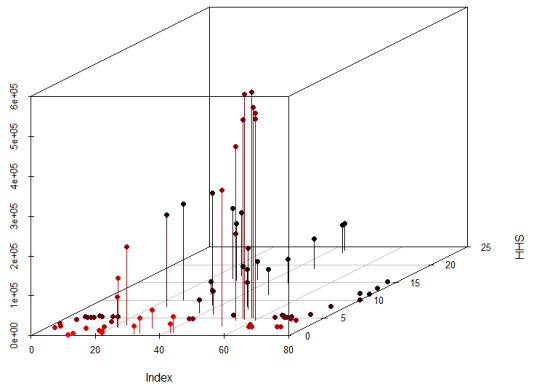


Figure B.23: Non-Financial Corporation Foreign Currency Loans & NPL (Balkans & CEE)

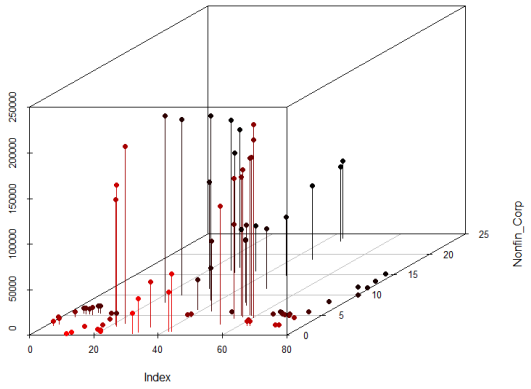
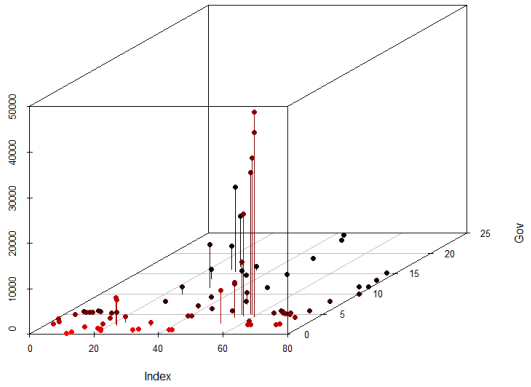


Figure B.24: Government Foreign Currency Loans & NPL (Balkans & CEE)



In the former figures from B.17 to B.34 are plotted the foreign currency loans in total and broken down in channels against the financial stability indicators. The vertical axis in each of the cases indicate the foreign currency loans amounts in millions of Euro, indexed by the author by using the historical exchange rate for each of the respective countries, while aiming to create a comparable and consistent dataset. The horizontal axis, named index, represents the total number of observations for the sample. Lastly, the right side axis represents the respective financial stability measures values.
Source: Author's Computation R-studio!

Table B.18: Pooled OLS: Z-Score Model (Balkans & CEE)

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
HH's FX Loans	7.48E-06	7.18E-06	7.51E-06	6.75E-06	7.30E-06	8.29E-06
	(3.52E-06)	(3.57E-06)	(3.49E-06)	(3.13E-06)	(3.07E-06)	(3.07E-06)
	*	*	*	*	*	**
Non-Fin. Corp. FX Loans	-1.65E-05	-1.56E-05	-1.66E-05	-1.31E-05	-1.45E-05	-1.35E-05
	(5.94E-06)	(6.15E-06)	(6.02E-06)	(5.44E-06)	(5.35E-06)	(5.30E-06)
	**	*	**	*	**	*
Gov. FX Loans	-1.65E-05	-3.21E-05	-3.36E-05	-4.08E-05	-4.15E-05	-5.46E-05
	(2.62E-05)	(2.65E-0.5)	(2.58E-0.5)	(2.32E-0.5)	(2.27E-0.5)	(2.32E-05)
				.	.	*
NPL	7.38E-05	6.09E-02	5.19E-02	1.41E-01	1.58E-01	1.59E-01
	(4.46E-02)	(4.98E-02)	(4.88E-02)	(4.64E-02)	(4.59E-02)	(4.53E-02)
				**	***	***
Inflation		-6.46E-02	-1.38E-01	-2.00E-01	-1.88E-01	-1.09E-01
		(1.10E-01)	(1.14E-01)	(1.00E-01)	(9.86E-02)	(1.04E-01)
				*	.	
Lending Rate			2.75E-01	3.09E-01	2.92E-01	2.70E-01
			(1.01E-01)	(9.04E-02)	(8.88E-02)	(8.81E-02)
			**	***	**	**
ROA				9.93E-01	5.03E-01	4.77E-01
				(1.72E-01)	(2.53E-01)	(2.50E-01)
				***	*	.
ROE					5.27E-02	5.22E-02
					(2.04E-02)	(2.01E-02)
					*	*
Cap. to RWA						1.58E-01
						(7.39E-02)
						*
Constant	6.62	6.89	4.99	3.41	3.41	0.84
	(0.47)	(0.66)	(0.94)	(0.89)	(0.87)	(1.47)
	***	***	***	***	***	
R-Squared	0.059	0.061	0.111	0.290	0.324	0.347
Adjusted R-Squared	0.031	0.026	0.071	0.252	0.283	0.302

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

This table summarizes the pooled OLS models with z-score as dependent variables. In addition, the normal values in the table stand for the beta coefficients of the variable, while the values in parenthesis represent the standard errors. Clustering has been included in the model.

Source: Author's Computation R-studio!

Table B.19: Pooled OLS: NPL Model (Balkans & CEE)

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
HH's FX Loans	-2.99E-05	-2.84E-05	-2.81E-05	-2.47E-05	-2.52E-05	-2.58E-05
	(6.34E-06)	(5.74E-06)	(5.79E-06)	(5.35E-06)	(5.27E-06)	(5.37E-06)
	***	***	***	***	***	***
Non-Fin. Corp. FX Loans	6.21E-05	6.31E-05	6.23E-05	5.18E-05	5.32E-05	5.27E-05
	(6.34E-06)	(9.38E-06)	(9.53E-06)	(8.99E-06)	(8.87E-06)	(8.92E-06)
	***	***	***	***	***	***
Gov. FX Loans	9.42E-05	5.03E-05	4.91E-05	6.37E-05	6.57E-05	7.39E-05
	(1.03E-05)	(4.57E-05)	(4.58E-05)	(4.22E-05)	(4.15E-0.5)	(4.34E-05)
	.					.
Z-score	2.68E-01	1.81E-01	1.62E-01	4.63E-01	5.24E-01	5.43E-01
	(1.62E-01)	(1.47E-01)	(1.52E-01)	(1.52E-01)	(1.52E-01)	(1.54E-01)
				**	***	***
Inflation		-9.57E-01	-9.81E-01	-6.74E-01	-6.51E-01	-6.92E-01
		(1.72E-01)	(1.79E-01)	(1.75E-01)	(1.72E-01)	(1.83E-01)
		***	***	***	***	***
Lending Rate			9.41E-02	-6.62E-02	-6.10E-02	-5.39E-02
			(1.82E-01)	(1.70E-01)	(1.68E-01)	(1.68E-01)
ROA				-1.61	-8.24E-01	-8.16E-01
				(3.19E-01)	(4.63E-01)	(4.64E-01)
				***	.	.
ROE					-8.69E-02	-8.74E-02
					(3.73E-02)	(3.74E-02)
					*	*
Cap. to RWA						-9.22E-02
						(1.38E-01)
						***
Constant	5.10	8.38	7.84	7.51	6.94	8.34
	(1.34)	(1.35)	(1.71)	(1.57)	(1.56)	(2.63)
	***	***	***	***	***	**
R-Squared	0.220	0.366	0.367	0.470	0.491	0.493
Adjusted R-Squared	0.197	0.342	0.339	0.442	0.460	0.458

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

This table summarizes the pooled OLS models with NPL as dependent variables. In addition, the normal values in the table stand for the beta coefficients of the variable, while the values in parenthesis represent the standard errors. Clustering has been included in the model.

Source: Author's Computation R-studio!

Table B.20: Fixed Effects: Z-Score Model (Balkans & CEE)

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
HH's FX Loans	-1.14E-06	-5.41E-07	-2.66E-08	1.62E-06	1.52E-06	4.02E-07
	(3.39E-06)	(3.37E-06)	(3.33E-06)	(2.52E-06)	(2.43E-06)	(2.15E-06)
Non-Fin. Corp.	-4.40E-06	-3.64E-06	-3.08E-06	-2.33E-06	-1.81E-06	1.42E-06
FX Loans	(4.78E-06)	(4.75E-06)	(4.69E-06)	(3.54E-06)	(3.43E-06)	(3.07E-06)
Gov. FX Loans	7.66E-06	1.27E-06	1.27E-06	-1.01E-06	-1.54E-06	-1.76E-06
	(1.92E-05)	(1.93E-05)	(1.93E-05)	(1.47E-05)	(1.43E-05)	(1.28E-05)
NPL	3.81E-02	1.77E-02	1.03E-02	7.44E-02	8.44E-02	7.85E-02
	(2.16E-02)	(2.40E-02)	(2.39E-02)	(1.92E-02)	(1.89E-02)	(1.67E-02)
	.			***	***	***
Inflation		-9.13E-02	-7.81E-02	-1.19E-01	-1.14E-01	3.73E-03
		(4.88E-02)	(4.85E-02)	(3.68E-02)	(3.57E-02)	(3.72E-02)
		.		**	**	
Lending Rate			-1.27E-01	-4.24E-02	-3.52E-02	-5.75E-02
			(6.01E-02)	(4.62E-02)	(4.48E-02)	(3.96E-02)
			*			
ROA				6.33E-01	4.38E-01	4.15E-01
				(6.60E-02)	(9.06E-02)	(7.99E-02)
				***	***	***
ROE					2.24E-02	2.35E-02
					(7.45E-03)	(6.56E-03)
					**	***
Cap. to RWA						1.93E-01
						(3.26E-02)
						***
R-Squared	0.033	0.060	0.094	0.489	0.525	0.635
Adjusted R-Squared	-0.101	-0.078	-0.048	0.403	0.441	0.567

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

This table summarizes the fixed effects models with z-score as dependent variables. In addition, the normal values in the table stand for the beta coefficients of the variable, while the values in parenthesis represent the standard errors. Clustering has been included in the model.

Source: Author's Computation R-studio!

Table B.21: Fixed Effects: NPL Model (Balkans & CEE)

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
HH's FX Loans	-1.31E-05	-5.10E-06	-3.65E-06	-8.05E-06	-7.61E-06	-6.28E-06
	(1.39E-05)	(1.27E-05)	(1.26E-05)	(1.13E-05)	(1.09E-05)	(1.09E-05)
Non-Fin. Corp.	6.50E-05	5.88E-05	5.89E-05	4.80E-05	4.33E-05	3.81E-05
FX Loans	(1.89E-05)	(1.71E-05)	(1.70E-05)	(1.53E-05)	(1.49E-06)	(1.52E-05)
	***	***	***	**	**	*
Gov. FX Loans	1.36E-04	5.03E-05	2.36E-05	7.11E-06	9.26E-06	3.40E-05
	(7.86E-05)	(7.29E-05)	(7.46E-05)	(6.63E-05)	(6.43E-05)	(6.59E-05)
	.					
Z-score	6.51E-01	2.53E-01	1.49E-01	1.49	1.70	2.02
	(3.69E-01)	(3.42E-01)	(3.47E-01)	(3.87E-01)	(3.82E-01)	(4.30E-01)
				***	***	***
Inflation		-8.95E-01	-8.51E-01	-4.27E-01	-3.83E-01	-5.15E-01
		(1.68E-01)	(1.70E-01)	(1.68E-01)	(1.63E-01)	(1.83E-01)
		***	***	*	*	***
Lending Rate			-3.49E-01	-3.67E-01	-3.60E-02	-3.06E-02
			(2.31E-01)	(2.05E-01)	(1.99E-01)	(2.01E-01)
				.	.	
ROA				-2.00	-1.22	-1.31
				(3.48E-01)	(4.32E-01)	(4.33E-01)
				***	**	**
ROE					-9.75E-02	-1.05E-01
					(3.36E-02)	(3.37E-02)
					**	**
Cap. to RWA						-2.93E-01
						(1.86E-01)
R-Squared	0.146	0.308	0.321	0.468	0.504	0.514
Adjusted R-Squared	0.028	0.205	0.213	0.379	0.416	0.423

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

This table summarizes the fixed effects models with NPL as dependent variables. In addition, the normal values in the table stand for the beta coefficients of the variable, while the values in parenthesis represent the standard errors. Clustering has been included in the model.

Source: Author's Computation R-studio!

Table B.22: F-Test for Fixed Effects (Balkans & CEE)

Dependent Variable	Model #	F-test: Testing for Fixed effects
Z-score	1	p-value < 2.2e-16
	2	p-value < 2.2e-16
	3	p-value < 2.2e-16
	4	p-value < 2.2e-16
	5	p-value < 2.2e-16
	6	p-value < 2.2e-16
NPL	1	p-value = 0.0003357
	2	p-value = 0.0003345
	3	p-value = 0.0001727
	4	p-value = 8.027e-06
	5	p-value = 2.351e-06
	6	p-value = 1.18e-06

Source: Author's Computation R-studio!

Table B.23: Tests for Autocorrelation, Heteroskedasticity and Cross-Sectional Dependence (Balkans & CEE)

Dependent Variable	Type	Model #	Breusch-Godfrey Test for Serial Correlation	Breusch-Pagan Test for Heteroskedasticity	Pesaran Test for cross-sectional Independence
Z-score	Pooled	1	p-value < 2.2e-16	p-value = 9e-04	p-value=0.039
		2	p-value < 2.2e-16	p-value = 0.001469	p-value=0.04686
		3	p-value = 1.57e-15	p-value = 0.0001383	p-value=7.859e-07
		4	p-value = 2.941e-15	p-value = 0.0001581	p-value = 8.504e-13
		5	p-value = 1.011e-15	p-value = 0.002684	p-value = 5.121e-15
		6	p-value = 3.11e-16	p-value = 0.003722	p-value = 9.088e-07
	Fixed	1	p-value = 8.168e-13	p-value = 9e-04	p-value=0.1948
		2	p-value = 9.458e-12	p-value = 0.001469	p-value=0.07123
		3	p-value = 6.297e-12	p-value = 0.0001383	p-value=0.2223
		4	p-value = 4.306e-09	p-value = 0.0001581	p-value=0.007355
		5	p-value = 1.513e-08	p-value = 0.002684	p-value=0.001422
		6	p-value = 2.197e-08	p-value = 0.003722	p-value=0.9597
NPL	Pooled	1	p-value = 5.146e-08	p-value = 0.00184	p-value < 2.2e-16
		2	p-value = 7.62e-07	p-value = 4.701e-05	p-value < 2.2e-16
		3	p-value = 2.317e-07	p-value = 0.0001214	p-value = 1.174e-12
		4	p-value = 4.829e-05	p-value = 9.613e-08	p-value = 2.597e-13
		5	p-value = 3.158e-08	p-value = 7.711e-06	p-value = 1.208e-09
		6	p-value = 2.49e-06	p-value = 1.665e-05	p-value = 4.471e-06
	Fixed	1	p-value = 3.781e-12	p-value = 2.066e-05	p-value < 2.2e-16
		2	p-value = 4.998e-11	p-value = 4.701e-05	p-value = 8.545e-07
		3	p-value = 1.504e-10	p-value = 0.0001214	p-value = 2.853e-06
		4	p-value = 1.848e-07	p-value = 9.613e-08	p-value = 0.05999
		5	p-value = 9.338e-08	p-value = 7.711e-06	p-value = 0.1532
		6	p-value = 1.613e-06	p-value = 1.665e-05	p-value = 0.08548

Source: Author's Computation R-studio!

Table B.24: Robust Fixed Effects: Z-Score Model (Balkans & CEE)

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
HH's FX Loans	-1.14E-06	-5.41E-07	-2.66E-08	1.62E-06	1.52E-06	4.02E-07
	(1.50E-06)	(1.49E-06)	(1.62E-06)	(1.02E-06)	(1.01E-06)	(1.14E-06)
Non-Fin. Corp.	-4.40E-06	-3.64E-06	-3.08E-06	-2.33E-06	-1.81E-06	1.42E-06
FX Loans	(4.56E-06)	(4.16E-06)	(4.04E-06)	(2.01E-06)	(1.66E-06)	(1.87E-06)
Gov. FX Loans	7.66E-06	1.27E-06	1.27E-06	-1.01E-06	-1.54E-06	-1.76E-05
	(1.07E-05)	(1.05E-05)	(1.24E-05)	(9.14E-05)	(9.31E-06)	(8.59E-06)
						*
NPL	3.81E-02	1.77E-02	1.03E-02	7.44E-02	8.44E-02	7.85E-02
	(2.98E-02)	(3.61E-02)	(3.43E-02)	(2.61E-02)	(2.83E-02)	(3.03E-02)
				**	**	*
Inflation		-9.13E-02	-7.81E-02	-1.19E-01	-1.14E-01	3.73E-03
		(5.19E-02)	(5.51E-02)	(3.92E-02)	(4.20E-02)	(2.89E-02)
		.		**	**	
Lending Rate			-1.27E-01	-4.24E-02	-3.52E-02	-5.75E-02
			(9.28E-02)	(3.96E-02)	(4.09E-02)	(3.15E-02)
						.
ROA				6.33E-01	4.38E-01	4.15E-01
				(9.35E-02)	(1.07E-01)	(9.09E-02)
				***	***	***
ROE					2.24E-02	2.35E-02
					(8.25E-03)	(7.37E-03)
					**	***
Cap. to RWA						1.93E-01
						(3.10E-02)
						***
R-Squared	0.033	0.060	0.094	0.489	0.525	0.635
Adjusted R-Squared	-0.101	-0.078	-0.048	0.403	0.441	0.567

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

This table summarizes the robust fixed effects models with z-score as dependent variables. In addition, the normal values in the table stand for the beta coefficients of the variable, while the values in parenthesis represent the standard errors. Clustering has been included in the model.

Source: Author's Computation R-studio!

Table B.25: Robust Fixed Effects: NPL Model (Balkans & CEE)

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
HH's FX Loans	-1.31E-05	-5.10E-06	-3.65E-06	-8.05E-06	-7.61E-06	-6.28E-06
	(1.41E-05)	(1.35E-05)	(1.33E-05)	(1.03E-05)	(1.02E-05)	(1.02E-05)
Non-Fin. Corp.	6.50E-05	5.88E-05	5.89E-05	4.80E-05	4.33E-05	3.81E-05
FX Loans	(3.70E-05)	(3.32E-05)	(3.33E-05)	(2.17E-05)	(2.19E-06)	(1.98E-05)
	.	.	.	*	.	.
Gov. FX Loans	1.36E-04	5.03E-05	2.36E-05	7.11E-06	9.26E-06	3.40E-05
	(6.91E-05)	(7.84E-05)	(8.64E-05)	(7.89E-05)	(7.75E-05)	(8.78E-05)
	.					
Z-score	6.51E-01	2.53E-01	1.49E-01	1.49	1.70	2.02
	(5.56E-01)	(5.53E-01)	(5.42E-01)	(4.87E-01)	(4.58E-01)	(3.78E-01)
				**	***	***
Inflation		-8.95E-01	-8.51E-01	-4.27E-01	-3.83E-01	-5.15E-01
		(1.79E-01)	(1.71E-01)	(2.14E-01)	(2.03E-01)	(1.76E-01)
		***	***	*	.	**
Lending Rate			-3.49E-01	-3.67E-01	-3.60E-02	-3.06E-02
			(1.46E-01)	(1.16E-01)	(9.69E-02)	(1.00E-01)
			*	**	***	**
ROA				-2.00	-1.22	-1.31
				(5.66E-01)	(4.45E-01)	(4.29E-01)
				***	**	**
ROE					-9.75E-02	-1.05E-01
					(2.91E-02)	(2.83E-02)
					**	**
Cap. to RWA						-2.93E-01
						(1.99E-01)
R-Squared	0.146	0.308	0.321	0.468	0.504	0.514
Adjusted R-Squared	0.028	0.205	0.213	0.379	0.416	0.423

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

This table summarizes the robust fixed effects models with NPL as dependent variables. In addition, the normal values in the table stand for the beta coefficients of the variable, while the values in parenthesis represent the standard errors. Clustering has been included in the model.

Source: Author's Computation R-studio!

Table B.26: Instrumetnal Variables Fixed Effects: Z-Score Model (Balkans & CEE)

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
HH's FX Loans	3.31E-06	4.02E-06	3.81E-06	5.47E-06	4.96E-06	2.55E-06
	(5.11E-06)	(5.05E-06)	(4.93E-06)	(3.47E-06)	(3.26E-06)	(2.84E-06)
Non-Fin. Corp.	-9.01E-06	-7.89E-06	-6.89E-06	-6.60E-06	-5.28E-06	-2.79E-07
FX Loans	(6.32E-06)	(6.25E-06)	(6.12E-06)	(4.31E-06)	(4.05E-06)	(3.60E-06)
Gov. FX Loans	8.80E-07	-8.49E-06	-2.33E-05	-1.23E-05	-1.29E-05	-2.77E-05
	(2.22E-05)	(2.24E-05)	(2.27E-05)	(1.60E-05)	(1.50E-05)	(1.31E-05)
						*
NPL	2.57E-02	2.37E-03	-7.85E-03	5.53E-02	6.57E-02	6.43E-02
	(2.31E-02)	(2.54E-02)	(2.52E-02)	(1.87E-02)	(1.77E-02)	(1.53E-02)
				**	***	***
Inflation		-1.01E-01	-8.61E-02	-1.23E-01	-1.18E-01	-1.78E-03
		(4.91E-02)	(4.84E-02)	(3.42E-02)	(3.21E-02)	(3.41E-02)
		*	.	***	***	
Lending Rate			-1.53E-01	-6.68E-02	-5.93E-02	-6.80E-02
			(6.22E-02)	(4.45E-02)	(4.17E-02)	(3.60E-02)
			*			.
ROA				6.33E-01	4.15E-01	3.91E-01
				(6.06E-02)	(7.99E-02)	(6.91E-02)
				***	***	***
ROE					2.55E-02	2.52E-02
					(6.62E-03)	(5.71E-03)
					***	***
Cap. to RWA						1.88E-01
						(3.21E-02)
						***
R-Squared	0. 014	0.050	0.100	0.558	0.616	0.716
Adjusted R-Squared	-0.140	-0.109	-0.061	0.474	0.539	0.656

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

This table summarizes the instrumental variables fixed effects models with z-score as dependent variables. In addition, the normal values in the table stand for the beta coefficients of the variable, while the values in parenthesis represent the standard errors. Clustering has been included in the model.

Source: Author's Computation R-studio!

Table B.27: Instrumental Variables Fixed Effects: NPL Model (Balkans & CEE)

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
HH's FX Loans	-2.23E-05	-1.05E-05	-1.03E-05	-1.57E-05	-1.43E-05	-1.03E-05
	(2.13E-05)	(1.93E-05)	(1.91E-05)	(1.76E-05)	(1.71E-05)	(1.69E-05)
Non-Fin. Corp.	6.74E-05	6.08E-05	6.08E-05	5.64E-05	4.98E-05	3.93E-05
FX Loans	(2.58E-05)	(2.32E-05)	(2.30E-05)	(2.11E-05)	(2.06E-05)	(2.11E-05)
	*	*	**	**	*	.
Gov. FX Loans	1.71E-04	5.51E-05	9.20E-06	-2.04E-07	4.27E-06	3.92E-05
	(9.18E-05)	(8.58E-05)	(8.87E-05)	(8.15E-05)	(7.90E-05)	(8.02E-05)
	.					
Z-score	4.09E-01	9.68E-04	-1.56E-01	1.36	1.75	2.23
	(4.05E-01)	(3.73E-01)	(3.79E-01)	(4.82E-01)	(4.91E-01)	(5.52E-01)
				**	**	***
Inflation		-8.73E-01	-8.19E-01	-4.47E-01	-3.77E-01	-5.50E-01
		(1.73E-01)	(1.74E-01)	(1.79E-01)	(1.76E-01)	(1.98E-01)
		***	***	*	*	**
Lending Rate			-4.44E-01	-3.95E-01	-3.67E-01	-3.07E-01
			(2.45E-01)	(2.25E-01)	(2.19E-01)	(2.18E-01)
			.	.	.	
ROA				-1.83	-1.20	-1.34
				(4.03E-01)	(4.57E-01)	(4.56E-01)
				***	**	**
ROE					-9.60E-02	-1.06E-01
					(3.61E-03)	(3.60E-02)
					**	**
Cap. to RWA						-3.97E-01
						(2.20E-01)
						.
R-Squared	0. 101	0.277	0.297	0.413	0.453	0.474
Adjusted R-Squared	-0.039	0.155	0.171	0.301	0.342	0.362

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

This table summarizes the instrumental variables fixed effects models with NPL as dependent variables. In addition, the normal values in the table stand for the beta coefficients of the variable, while the values in parenthesis represent the standard errors. Clustering has been included in the model.

Source: Author's Computation R-studio!

Table B.28: General Method of Moments: NPL Model (Balkans & CEE)

Variables	Auto. Sel. of IV matrix	Reduced Form of IV	IV Matrix where # Moments Grows with KT	Arellano & Bond (1991) Instruments
HH's FX Loans	1.42E-05	9.40E-06	6.89E-06	9.03E-06
	(8.25E-06)	(9.93E-06)	(7.74E-06)	(9.83E-06)
Non-Fin. Corp. FX	4.58E-06	-1.39E-06	-3.37E-06	2.53E-06
Loans	(1.01E-05)	(1.06E-05)	(9.88E-06)	(1.06E-05)
Gov. FX Loans	1.23E-04	1.80E-04	1.62E-04	1.22E-04
	(5.24E-05)	(6.37E-05)	(4.38E-05)	(6.79E-05)
	*	*	***	.
Z-score	-1.89E-03	-1.36E-03	-1.75E-03	-1.39E-03
	(5.46E-04)	(5.88E-04)	(6.01E-04)	(5.74E-04)
	**	.	**	*
Inflation	-1.58E-03	-7.97E-04	-1.18E-03	-8.45E-04
	(4.58E-04)	(3.43E-04)	(4.07E-04)	(3.47E-04)
	**	.	**	*
Lending Rate	6.31E-04	4.68E-04	6.40E-04	4.45E-04
	(1.82E-04)	(2.01E-05)	(2.19E-04)	(1.83E-04)
	**	.	**	*
ROA	-2.33E-03	-1.59E-03	-2.21E-03	-1.66E-03
	(6.73E-04)	(6.87E-04)	(7.61E-04)	(6.84E-04)
	**	.	**	*
ROE	-4.62E-02	-3.19E-02	-4.02E-02	-3.34E-02
	(1.33E-02)	(1.37E-02)	(1.38E-02)	(1.37E-02)
	**	***	**	*
Cap. to RWA	1.13E-04	-1.34E-04	-1.28E-04	-8.28E-05
	(3.27E-05)	(5.81E-05)	(4.40E-05)	(3.40E-05)
	**	.	**	*
Lagged Dep.	6.42E-06	-4.02E-04	-7.15E-04	-3.06E-04
	(1.84E-06)	(1.73E-04)	(2.45E-04)	(1.26E-04)
	**	.	**	*
R-Squared	0.073	0.063	0.065	0.071
Adjusted R-Squared	-n/a-	-n/a-	-n/a-	-n/a-

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

This table summarizes the general method of moments models with NPL as dependent variables. In addition, the normal values in the table stand for the beta coefficients of the variable, while the values in parenthesis represent the standard errors.

Source: Author's Computation R-studio!